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the OIL AND GAS JOURNAL

PUBLISHED WEEKLY

Aug 10 1959

Oil stages big recovery during first half ▸ 57

Offshore Louisiana: Expensive but attractive ▸ 66

Japanese well in Persian Gulf blows wild ▸ 80

Drilling and producing on a 1-acre island ▸ 82

Is there more oil at Titusville? ▸ 144

Unitization by Mail

Oil companies are saving time and money by using mail instead of people to sell unitization to royalty owners

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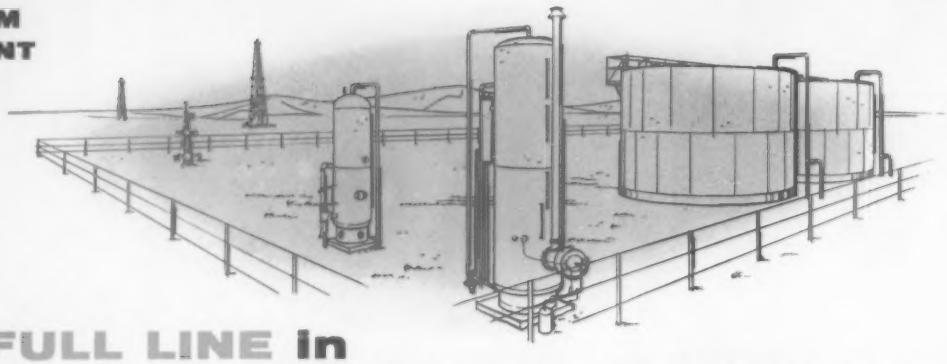
LONG-TERM INVESTMENT PACKAGE



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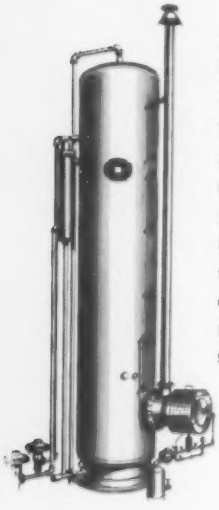

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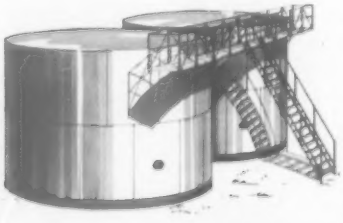

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OIL AND GAS JOURNAL
Vol. 57 No. 33

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TECHNOLOGY—OPERATION

Drilling

Richfield Conducts Drilling and Production Operations on 1-Acre Island 82

By D. H. Stormont

All surface facilities for a several-hundred-acre oil field are squeezed into this small space about ½ mile offshore from Rincon, Calif. Ultimately 68 wells may be completed in a cellar that extends along the west side of the working area.

Gilsonite Gives Low-Density Cement, Lost-Circulation Slurry 107

By K. A. Slagle and L. G. Carter

This material has been used on more than 200 jobs since it was introduced as a cement additive in 1957. Operations have included primary cementing through lost-circulation zones and remedial jobs such as squeezing, recementing above inadequate fillup, and plugging back to regain mud circulation.

Production

Richfield Conducts Drilling and Production Operations on 1-Acre Island 82

By D. H. Stormont

Graphical Solution to Fluid-Coning Problems 101

By C. P. Rosales, J. H. Vera, and E. G. L. Mendoza

A nomographic procedure has been developed to simplify the cumbersome calculations involved in the Muskat-Wyckoff coning theory. It applies to both non and partially penetrating wells. Two nomographs for specific values of well and drainage radii are included for determining the maximum pressure drop without water or gas-cone breakthrough.

Reservoir Engineering—13 119

By E. T. Guerrero and F. M. Stewart

How to determine effective permeability from pressure-buildup data under infinite boundary conditions.

Refining

New Isom Process Gives Octane Improvement at 5-10 Cents Per Octane-Barrel 90

This process for upgrading C_5/C_6 virgin naphthas employs a highly active catalyst which permits liquid-phase operation at low temperature, 80° to 120° F. Equilibrium isomer distribution at this temperature level favors formation of the branched, high-octane isomers.

Systems Engineering Will Be Boon to Processing Plants 93

By Theodore J. Williams

The next 10 years will see solution of more of the problems in use of systems engineering and computer application. Industry will then be engaged in economic automation—i.e., as much instrumentation and automatic control as can be economically justified.

The Foreman's Page 98

Here's how one refinery handles safety valves and their maintenance.

Light-Ends Fractionating at Phillips' Sweeny Refinery 115

By Larry Resen

Natural-gas-liquids fractionating units at this refinery have the capacity to handle more than 47,000 bbl. of feed daily. Tied in with the main fractionating towers is a pentane section with a capacity of more than 20,000 bbl. per day. Debutanizer bottoms plus refinery low-end-point gasoline are processed in this second stage.

Pipelining

The Why and How of Mass-Flow Measurement 87

By Harry P. Bean

The heat energy in a pound of natural gas varies less with composition changes than does heat energy on a cubic-foot basis. It therefore makes sense to measure gas by weight instead of by volume. Three different methods of measuring weight of flowing gas have been field tested and proved accurate.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
August 10, 1959

Figures coming in show oil did well in first half:

Company profits made sharp gains over those recorded in last year's recession period.

Reasons cited for the improvement: Better product prices, greater demand, stepped-up crude production, cost-cutting programs, and general upswing of the economy (p. 57).

Rest of the year also should be good, company executives believe. What happens, however, will depend on the length of the steel strike and the current refinery strikes, and the trend of crude and product prices.

How does oil compare with other industries?

First National City Bank of New York reports 36 oil-producing and refining companies had combined net of $544 million in second quarter, off 10% from first quarter but up 30% from second quarter of 1958.

For first half these companies had combined net of $1,146 million against $925 million last year, up 24%.

But oil's 30% increase for quarter and 24% for half is less than 67% second-quarter gain and 56% midyear gain shown by 808 U.S. companies.

▼ ▼ ▼

Definite improvement in the Group 3 gasoline market was made last week.

Suppliers and brokers are moving regular for 11.25 cents a gallon, up at least a quarter cent from the week before. One supplier jumped the price to his jobber in Des Moines to 11.5 cents. Some big buyers report prices range upward from 11.2 cents.

On the Gulf Coast, one cargo of regular went at 11 cents. There are reportedly six other cargoes available and likely could be had at the low.

One trend of the market: The margin between regular and premium is narrower. On the spot market, premium is not bringing the usual 3-cent differential. The spread is down to 2.5 or 2.75 cents. On the Gulf Coast it's only 2 cents.

The spread may settle down to 2.5 cents, particularly since Great Lakes Pipeline's last boost of 2 octane numbers on regular. It put regular closer to premium. The octane ratings are now 91 for regular and 99 for premium against former 89 and 99 ratings.

Crude-oil people think chances are still good for a general East Texas price cut.

Next move is expected to come from Sun or Sinclair —probably Sun. If so, the action could swing the balance in favor of Atlantic's 20-cent cut.

The Atlantic cut prompted the Venezuelan Government to call oil representatives on the carpet. Caracas officials wanted a full explanation. Royalties paid by oil producers in Venezuela are based partly on the East Texas price. A cut there nicks Venezuelan income (p. 79).

▼ ▼ ▼

As steel strike winds up first month, oil feels no pain.

Suppliers report: It's quiet, but no one is hurting yet. Second-hand dealers aren't swamped either. But they aren't anxious. If strike lasts long enough, they'll thrive. Canadian mills are selling some pipe, mostly in the East. Foreign pipe hasn't made much of an intrusion yet.

Purchasing agents say: Most companies still are in a comfortable inventory position. Pinch will start developing if strike goes into October, as some now predict.

Refinery strikes also rock along with no encouraging moves toward early settlement.

Trouble even spread when Whiting pickets motored across Illinois to march before gates at Indiana Standard's Wood River refinery. When workers honored the picket lines, company started shutting down the plant.

Indiana Standard has returned Sugar Creek to nearly half production and has started up limited operations at Whiting. Amoco is doing the same at El Dorado and Texas City. In each instance supervisory help are manning the units.

Crude purchases have been cut to 80% by Indiana in Oklahoma, Kansas, and parts of West Texas, and to 10% in southern Arkansas and Northern Louisiana. Normal buying has been resumed on Gulf Coast where Indiana can sell its surplus.

▼ ▼ ▼

Jolt has been dealt Rocky Mountain scout check. Seven majors have voted to withdraw from check effective October 1 and subscribe to a detailed scouting service offered now by Petroleum Information, Denver (OGJ, Aug. 3, p. 44).

The seven majors are Shell, Sun, Pure, Ohio, Pan American, Continental, and Carter. The checks affected are Billings, Casper, Denver, Bismarck, Durango, and Salt Lake City.

General manager of new well service will be William Brandon, for last 18 years with Richfield in California as geologist and economist. He's moving to Denver.

Koyukuk basin in Alaska's interior will get wildcat test. It'll probably spud in by October.

Back of the $2-million test is a syndicate of 47 leaseholders in the basin headed by Paul Benedum. It represents 33 different oil interests that control over 4 million acres.

Arizona has a new producing horizon—the Mississippian.
Texas Pacific's wildcat in northern Apache County also gives Arizona its third field and its third oil well.
Its 1 Navajo Tract 188 is 8 miles south of Boundary Butte production and 15 miles southwest of Bita Peak, the state's other field. Well is making 240 bbl. of oil and 27 bbl. of water bail from perforated interval at 5,566-89 ft.

Drilling may pick up off Louisiana.
Federal lease sale this week and state sale next month may be the stimulant.
Drilling operations have been hurt by high costs, low allowables, uncertainty of tidelands ownership, and the world oil oversupply situation.
Oil men still have confidence in the region, called one of the really great domestic oil frontiers (p. 66).

Japanese wildcat in new offshore concession of Neutral Zone hit high pressure gas zone, blew out, and caught fire.
About $5 million worth of American-owned and operated equipment is in jeopardy. Rig has toppled. Mobile drilling platform may be lost too (p. 80).

▼ ▼ ▼

Petroleum waxes are getting more attention as possible building blocks for polymer synthesis.
Wax itself is a low molecular polymer. Research is under way to find whether waxes can be reacted with other materials to produce high polymers for use as polishes, paper coatings, and plastics.

Refiners now have new yardstick for catalyst quality.
Quarterly reports have been begun on activity, surface area, and contamination by five metals in fluid catalysts sampled around the country. Davison Chemical is making the survey.
The sampling covers roughly half the fluid capacity now in operation. First report for the February-April period this year shows activity off from previous quarter and a year ago (p. 75).

▼ ▼ ▼

Texas Eastern after 3 years' experience can report these benefits from its gamble with 15,000-hp. electric-motor-driven gas compressors:
...Lowest initial cost in the industry.

...Low operating costs and negligible maintenance.
...Reliability which justified the design (p. 58).

Group of Houston independendent gas producers is negotiating with eastern Oklahoma and western Arkansas producers for reserves to support several gathering systems.

Houston group is in the market for at least 200,000 M.c.f. daily to sell to an interstate line. Several other parties also are interested in this hot area which has scattered shut-in reserves.

Pattern for major gas deals of the future may have been set by Texas Eastern's leasehold purchase in the trillion-cubic-foot Rayne field of South Louisiana.

This unique type of purchase cut initial cost of the gas, eliminated price escalations and indeterminate price increases common to gas contracts. It gives the buyer control over rate of production.

▼ ▼ ▼

The Methane Pioneer is still scheduled for more trips hauling liquefied methane from Louisiana to England.

It has proved itself but Constock fears if ship were taken out of service now, move would be misinterpreted. Constock reportedly has men working on designs for a larger ship and has two or three long-range contracts in the making for gas supply and market.

Tidewater has sent answers to 16 questions raised by Justice Department on merger with Skelly.

Answers covered history of merger talks and all the major aspects of Tidewater's operations.

Median income for professional engineers has hit a record $10,000 annually, up 27% since 1952.

Greatest gains in last 2 years were made by engineers with less than 10 years' experience. Smallest by those who entered profession in 1915-19 (p. 69).

Industry notes: Tidewater stations will honor Hilton Carte Blanche credit cards along with Socony Mobil...Survey tells Colorado officials private industry will invest $6 billion in state's oil-shale industry within next 15 years and that daily output may be 1,250,000 bbl. by 1975...Use of chain tong lines will be permitted on California drilling rigs generally for first time. It's part of major overhaul of state's drilling-production safety code...Navajos got offers up to 77.1% royalty on tracts in greater Aneth field... Congress has approved bill doubling acreage limit on federal leases and options in Alaska. New limit is 600,000 acres.

Good Wells Make Good News

Recent Treatments Engineered With the Aid of the "Frac Guide"

August 10, 1959

Fracturing is more dependable and effective than ever before -- thanks to the new "Frac Guide*" developed by Dowell. Here are results on four recent treatments that were engineered using the "Frac Guide."

- Andrews County, West Texas (Old Oil Well) This well was completed through perforations into the San Andres at about 4300 feet. Production had declined to 25 bopd. Dowell recommended Sandfrac* after engineering a treatment with the "Frac Guide." 25,000 gallons of refined oil carrying 63,000 pounds of sand were injected at 25 bpm. After clean-up, the well tested 107 bopd.

- Uintah County, Utah (Old Oil Well) Production from this well had declined to 10 bopd. The pay was the Weber sand from 4180 to 4280 feet. Dowell engineered a treatment using the "Frac Guide" and recommended Riverfrac.* 15,000 gallons of water with 23,000 pounds of sand, F.L.A.* (Fluid Loss Additive) and a silicate control agent were injected down two-inch tubing at 12 bpm. 2½ months later the well was still producing 130 bopd in an area where fractured wells usually drop off to less than 50 bopd.

- Cowley County, Kansas (New Oil Well) This development well was completed into a 16-foot section of the Bartlesville sand beginning at 3200 feet. The "Frac Guide" indicated the use of Sandfrac with 10,000 gallons of lease oil, a fluid loss control agent and 30,000 pounds of sand. After treatment the well tested 40 boph on a ¼-inch choke -- 400 to 800 per cent better than other fractured wells in the area.

- Coke County, Texas (New Oil Well) This well was completed through perforations into five sections of the Strawn between 6496 and 6628 feet. Dowell engineered a treatment with the "Frac Guide" and recommended Petrojel*. Gelled crude with a fluid loss control agent was injected in three 5000-gallon stages. 22,500 pounds of 20-40 mesh sand were used to pack the fractures created. This well produced 86 bopd on 9/64" choke with a gor of 2000. Comparable wells usually produce about 65 bopd on 9/64" choke with a gor of 3500 to 4000:1.

Take advantage of Dowell's unequalled experience in engineering treatments with the "Frac Guide." There is no additional cost. For service or detailed information, contact the Dowell office or station nearest you. There are more than 165 locations in the United States, Canada, Venezuela and Argentina. Dowell, Tulsa 1, Oklahoma.

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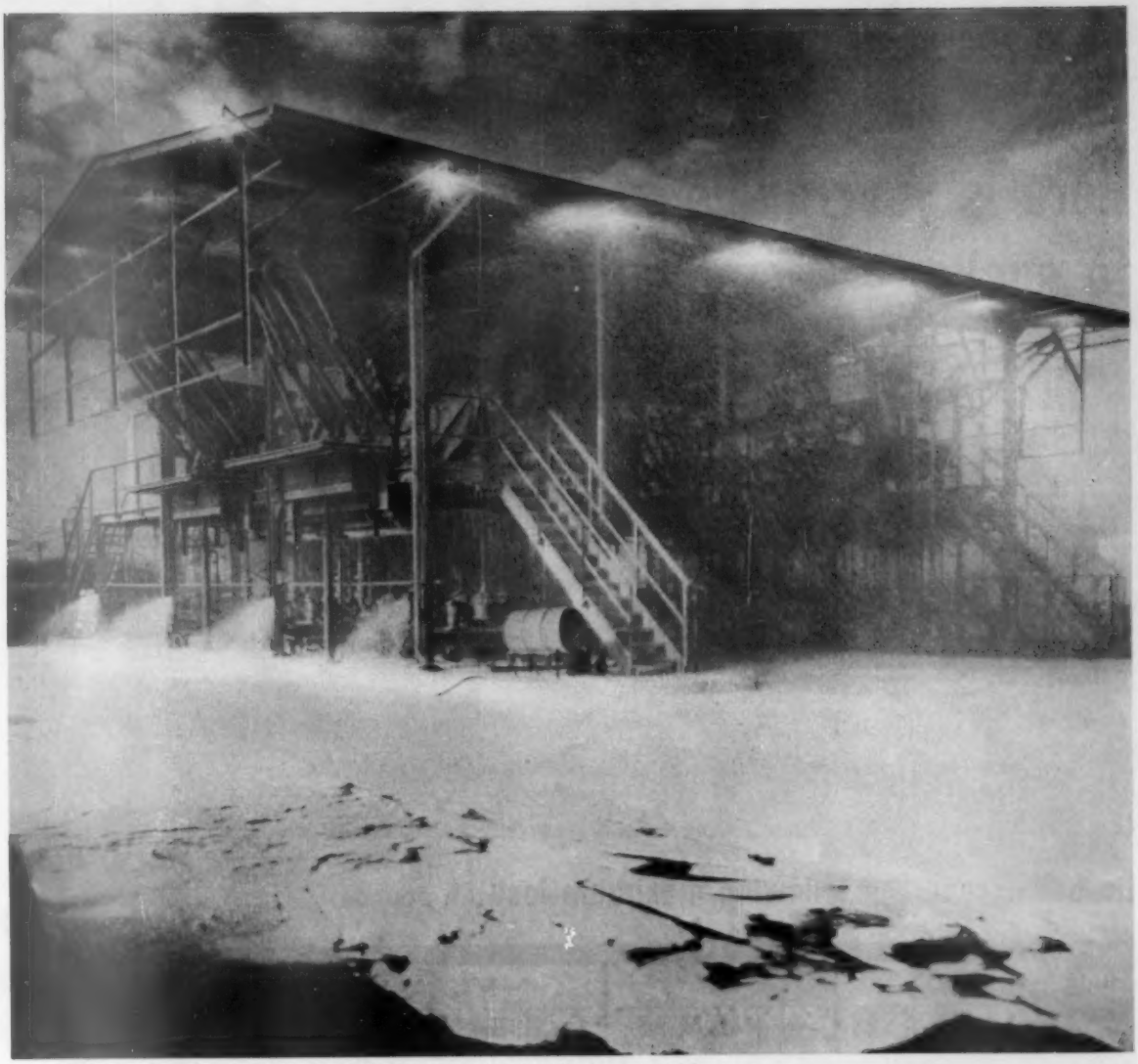

2 minutes after start of system under test. Note how fire-extinguishing foam blankets potential fire area.

This test shows how Grinnell's Spray-Foam System protects hazardous fire areas

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- ProtectoFoam* systems, producing mechanical foam
- Carbon dioxide systems
- Dry chemical systems

*Reg. U. S. Pat. Off.

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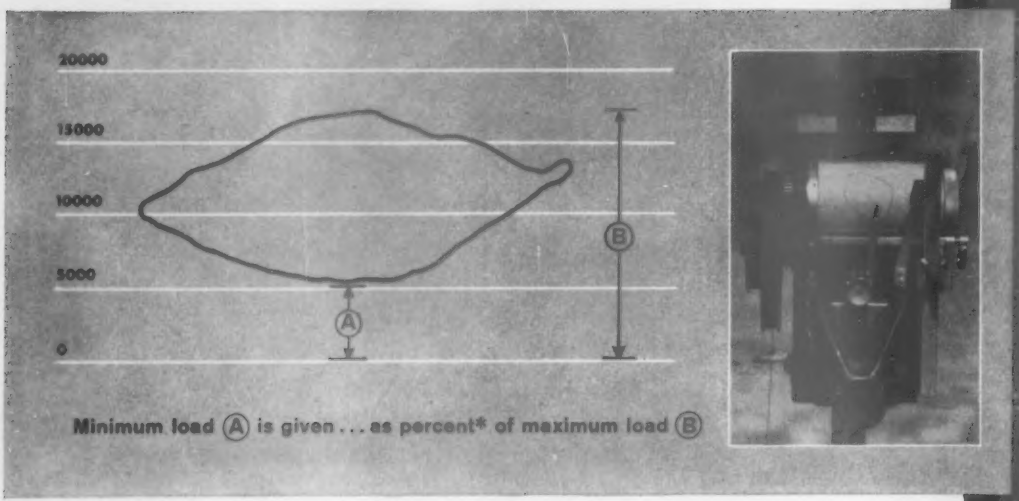
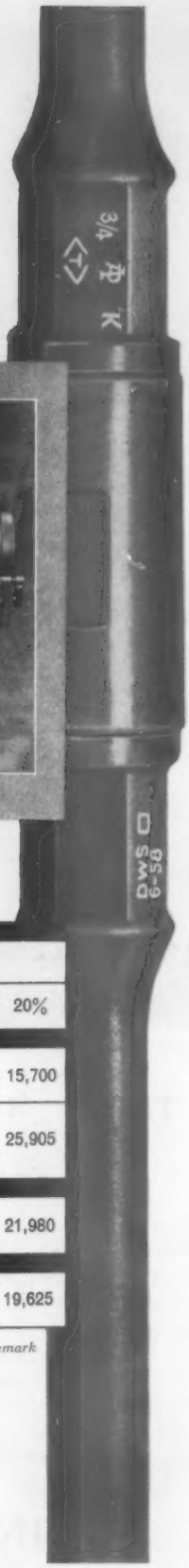
Here is your guide to sucker rod loading!



Minimum load (A) is given . . . as percent* of maximum load (B)



Do not exceed the following maximum load (in pounds)!

GRADE	SIZE											
	⅝"			¾"			⅞"			1"		
*	60%	40%	20%	60%	40%	20%	60%	40%	20%	60%	40%	20%
	NON-CORROSIVE OR EFFECTIVELY INHIBITED											
N	8,596	7,982	6,140	12,376	11,492	8,840	16,828	15,626	12,020	21,980	20,410	15,700
Y	12,280	11,052	10,131	17,680	15,912	14,586	24,040	21,636	19,833	31,400	28,260	25,905
	CARBON DIOXIDE OR SWEET CORROSION											
L	10,745	9,517	8,596	15,470	13,702	12,376	21,035	18,631	16,828	27,475	24,335	21,980
	HYDROGEN SULPHIDE OR SOUR CORROSION											
T	10,745	9,210	7,675	15,470	13,260	11,050	21,035	18,030	15,025	27,475	23,550	19,625

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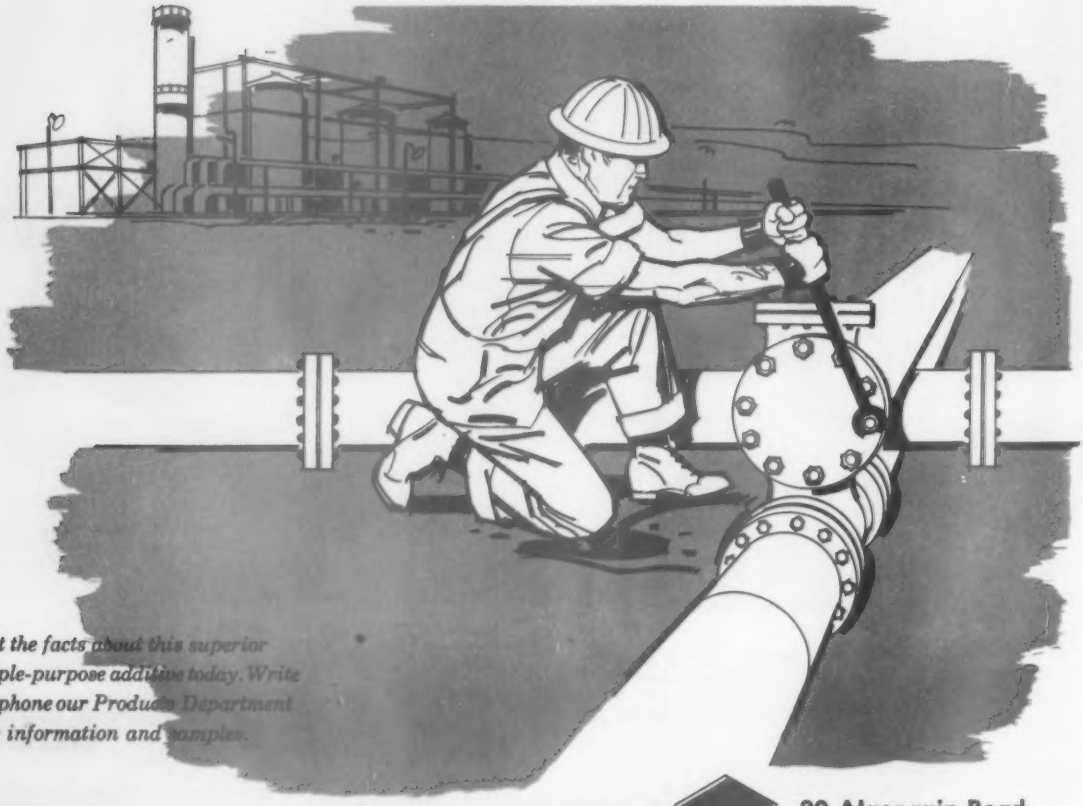

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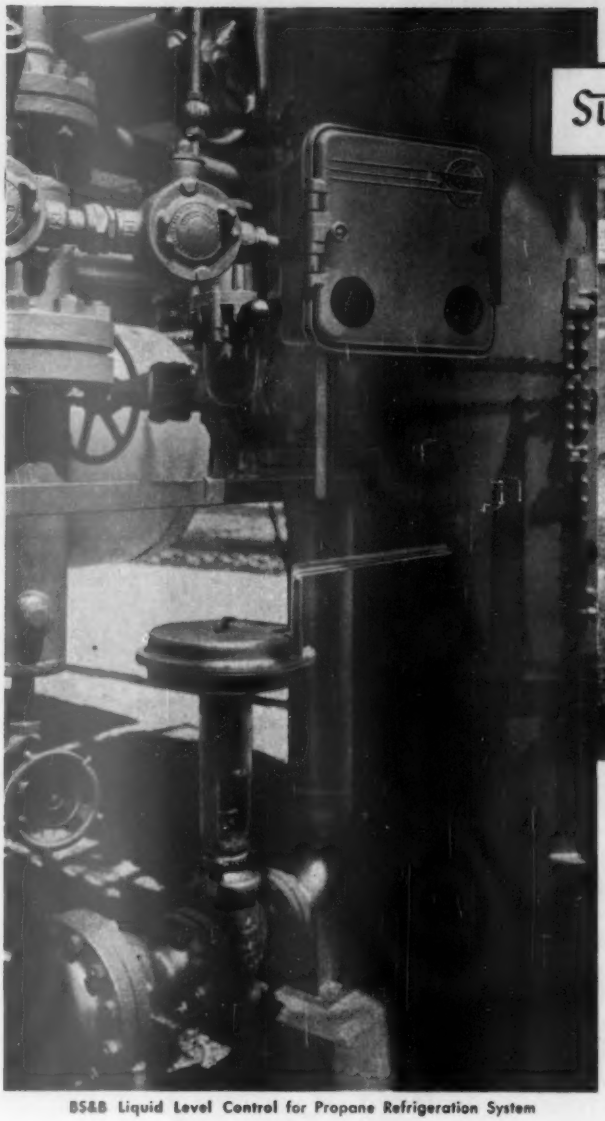
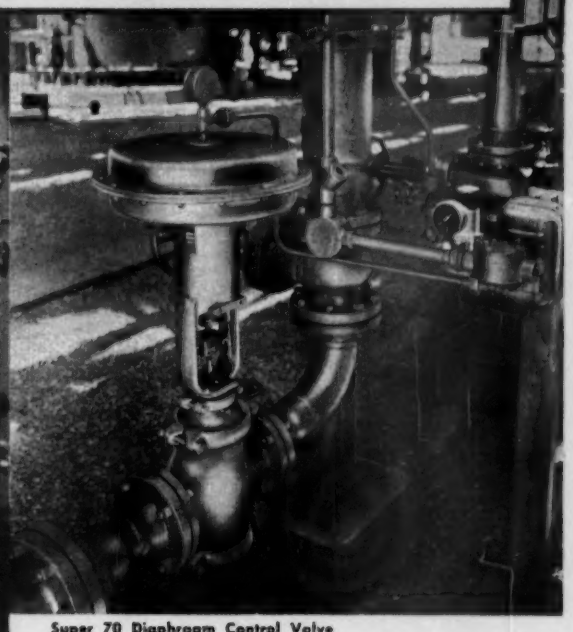


BS&B Liquid Level Control for Propane Refrigeration System

Super 70's "On Stream"



Super 70 Diaphragm Control Valve
as Debutanizer Reflux Flow Controller

BS&B

ELECTRO-PNEUMATIC CONTROLS SERVING WARREN'S MONT BELVIEU PLANT

In their Mont Belvieu Fractionation Plant, Warren Petroleum Corporation separates propane, isobutane, normal butane and natural gasoline. Efficient day in, day out operation of this large plant is assisted by BS&B Super 70 Control Valves, Liquid Level Controls and Regulators.

A complete modern electronic control system was designed and installed in Mt. Belvieu for the control of precise product purity. BS&B's level controls and control valves were selected as primary and final control elements, due to their superior performance characteristics and rugged dependability.

BS&B Controls are proving their superiority in service the world over. Specify them on your next job.

BS&B
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

Controls Division, Dept. 4-A8
7500 East 12th Street Kansas City 26, Missouri

GRANT Oil Tool

announces the acquisition of

COSASCO DIVISION

of Perfect Circle Corporation

and the Cosasco line of patented access fittings

(the original "Scotch" nipple)

for corrosion surveys and unitized wellheads.

Effective July 13, 1959, it becomes the Cosasco Division of Grant Oil Tool Company and will be headquartered in our main plant in Los Angeles. The same high manufacturing standards exhibited in the broad Grant line of down-hole and surface tools and MacClatchie equipment will assure the continued excellence of Cosasco products.

GRANT OIL TOOL COMPANY

Main Office and Plant:
2042 East Vernon Avenue, Los Angeles 58, California
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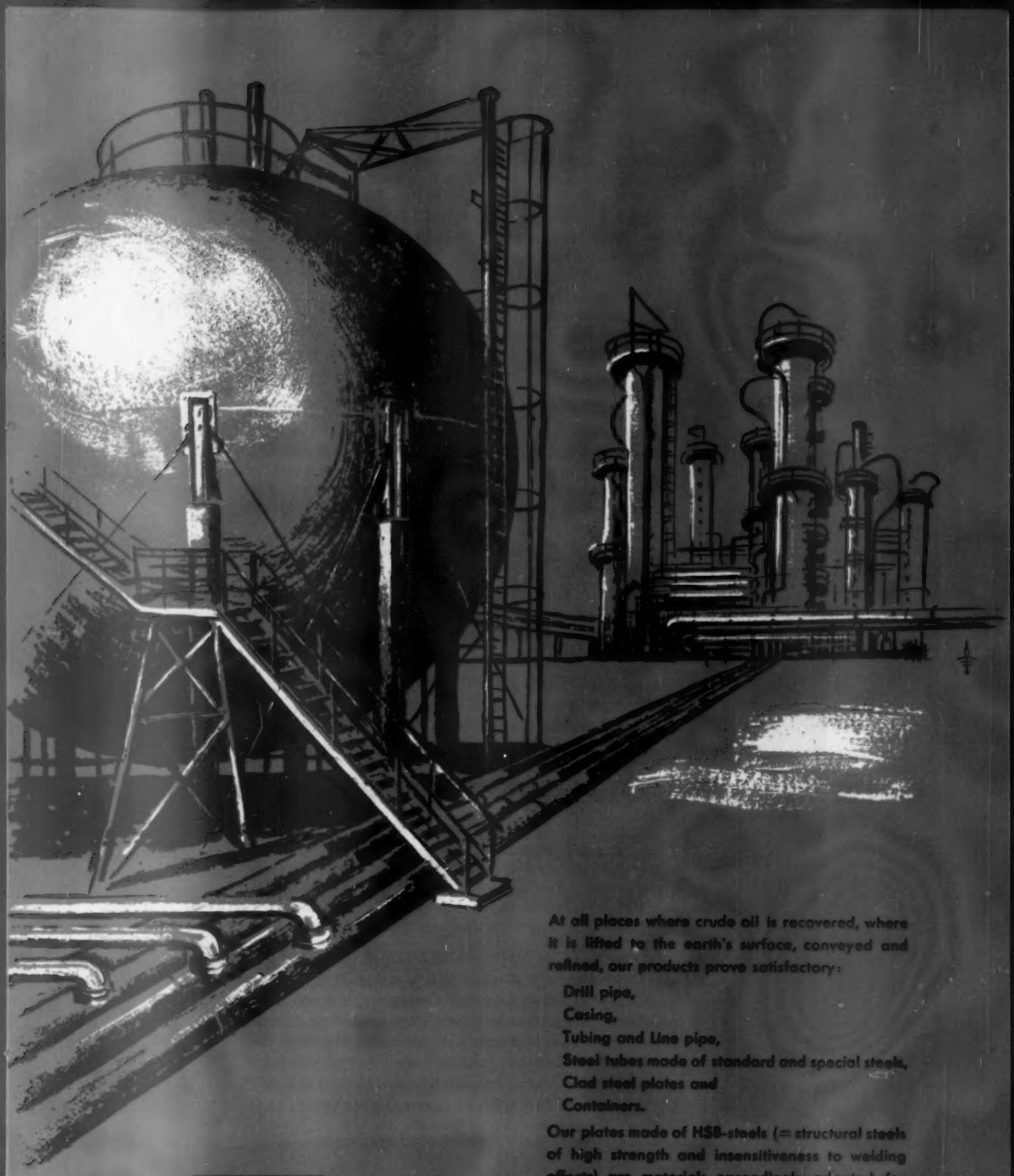

At all places where crude oil is recovered, where it is lifted to the earth's surface, conveyed and refined, our products prove satisfactory:

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Casing,
Tubing and Line pipe,
Steel tubes made of standard and special steels,
Clad steel plates and
Containers.

Our plates made of HSB-steels (= structural steels of high strength and insensitiveness to welding effects) are materials exceedingly adapted for the construction of modern ball gas containers.

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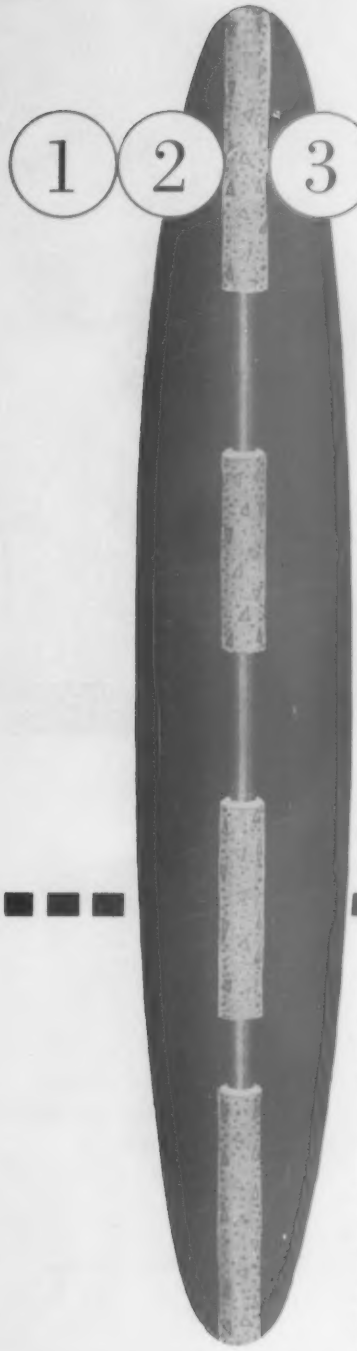


1 2 3 4 MORE THAN ONE ADVANTAGE

multiple stage cementing
BY HALLIBURTON

for:

1. Cementing Off Formations at Any Point
2. Full Depth Cementing
3. Reduced Pump Pressures
4. Reduction of Cement Loss to Thieving Formations

Two or Three Stage Cementing by Halliburton permits the placement of from one to three different tailored cement slurries through the casing shoe and by means of the Halliburton "DV" Multiple Stage Cementing Tool at one or two pre-determined points in the casing string... *all in one operation!*

Halliburton's Multiple Stage Cementing means multiple benefits for you: Saves time and money... Helps provide greater protection of casing and formations... for longer well life.

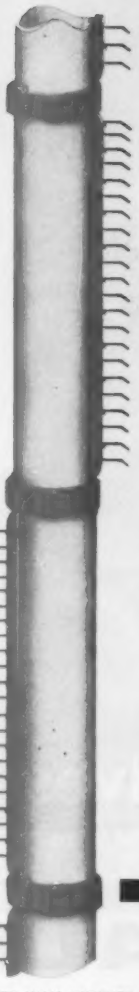
Each Of These Halliburton Tools Contributes To Better Multiple Stage Cementing

HALLIBURTON "DV" MULTIPLE STAGE CEMENTER... for primary cementing of casing string. With one or two "DV" Multiple Stage Cementers, opening and closing plugs, two- and three-stage cementing on the same string is possible... in continuous operation or at desired intervals... using two or three different types of materials. Designed for positive fluid shut-off by means of hydraulically operated steel sleeves and high pressure packing.

"DV" MULTIPLE STAGE CEMENTER

S-3 CASING CENTRALIZER

HALLIBURTON S-3 CASING CENTRALIZER... with heat-treated, lap-welded springs to minimize channeling... aids in effecting uniform placement of cement around casing. Helps to minimize future remedial costs. Specially designed Casing Centralizers of Heavy Duty and Slim Hole types for unusual well conditions are available.

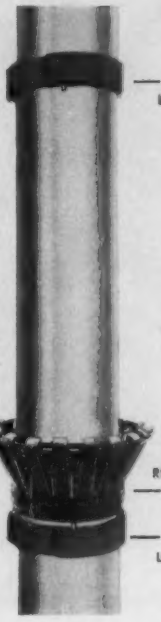


NEW ROTO WALL CLEANER INSTALLED WITH VISE-LOK LIMIT CLAMPS

HALLIBURTON ROTO WALL CLEANER . . . Used in primary and plug-back cementing . . . Special claw-type cleaning spikes made of high tensile strength spring steel thoroughly clean mud cake from wall of hole and allow a better bond of cement between casing and side wall formation. Casing is run in and rotated after it is landed at casing point . . . before and during cementing operations. Precautionary and remedial squeeze jobs can be eliminated altogether or greatly reduced . . . when plugging back in open hole, a satisfactory water shut-off may be obtained by the use of Roto Wall Cleaners. New test-proven designed base permits use of Vise-Lok Limit Clamp to hold wall cleaner in stationary position on casing in place of tack welding.

HALLIBURTON RECIPO WALL CLEANER . . . Removes mud cake from wall of hole to allow better bonding of cement to formation and casing . . . Wide, flexible, tough rubber fingers minimize bore hole or mud cake damage while running casing, yet are sufficiently rugged to thoroughly clean more bore hole area and aid in breaking up channeling of cement when casing is reciprocated . . . Wide fluid passage between cleaning fingers help reduce circulating pressures and bridging action of mud cake cuttings in the annulus.

HALLIBURTON VISE-LOK LIMIT CLAMP. . . A new method of installing Roto Wall Cleaner, Recipo Wall Cleaners, Casing Centralizers and Cement Baskets on casing at selected spacing without harmful welding of lugs or limiting devices. Hinged for easy installation . . . Locking force is created by special file hard gripping disc slips inside the hinged steel ring and forced against the casing by taper pins driven in from behind . . . holds up to 20,000 lbs. loading.

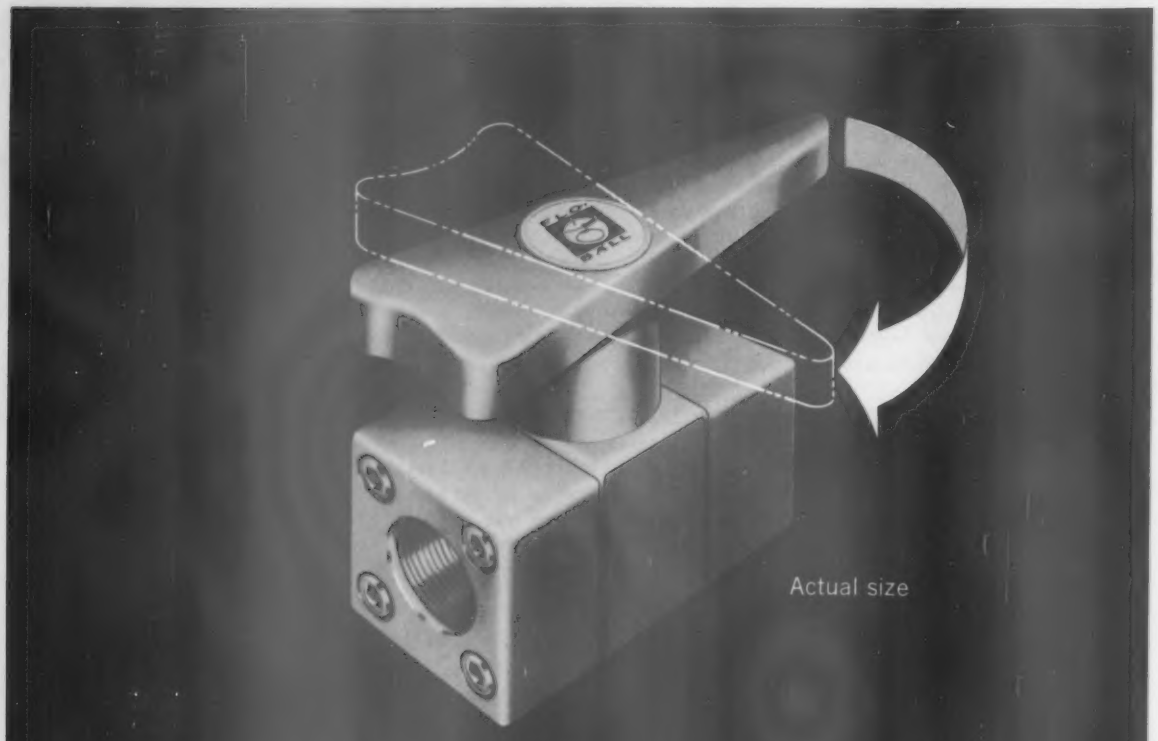


HALLIBURTON CEMENT BASKET. . . Run on casing or liner to help support cement column load until it takes its initial set . . . most desirable in weak or porous formations to provide extra protection from slurry loss or formation breakdown. High strength flexible steel staves permit fluids to by-pass while running casing, circulating or cementing . . . insert liner is resistant to oil, weak acids and mud chemicals . . . basket retains cement under hydrostatic pressure from above. . . Used below *"DV" Multiple Stage Cementer* to help retain the first stage of cement above weak formations; also used on liner jobs below a Halliburton Type "H" Baffle Collar with cementing ports offering protection of producing formation from cement contamination.

CEMENT BASKET

HALLIBURTON CEMENTING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA



Replace obsolete needle valves with the NEW 90° ON-OFF *FLO-BALL*

For 3,000 PSI...

Low torque, instant action . . . a fast 90° turn, requiring just 4 inch-pound torque at 3,000 psi, actuates the valve instantly!

Priced no higher than needle valves!

100% flow efficiency . . . straight-thru ***FLO-BALL*** design has more than twice the flow efficiency of needle valves!

Positive ON-OFF indication . . . large arrow-shaped handle shows valve position at a glance!

Zero leakage . . . Mass Spectrometer tests with Helium prove zero leakage!

Universal mounting . . . can be panel, side, bottom, or line mounted!

Removable flanges . . . damaged flanges can be removed in seconds; no need to replace entire valve!

All stainless steel construction . . . costs no more than old fashioned screw-type valves!

Versatile service . . . ideal for leakproof control of air, vacuum, steam, water, fuels, oils, kerosene, alcohol, and many other fluids.

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Size	Part No.	Size	Part No.
⅛	715A1	⅛	715A2
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Other models are available for service with cryogenic and corrosive media. Also special designs for throttling flow control.

Write today for new catalog describing the world's most complete line of precision valves for industrial and military applications.

FLO-BALL

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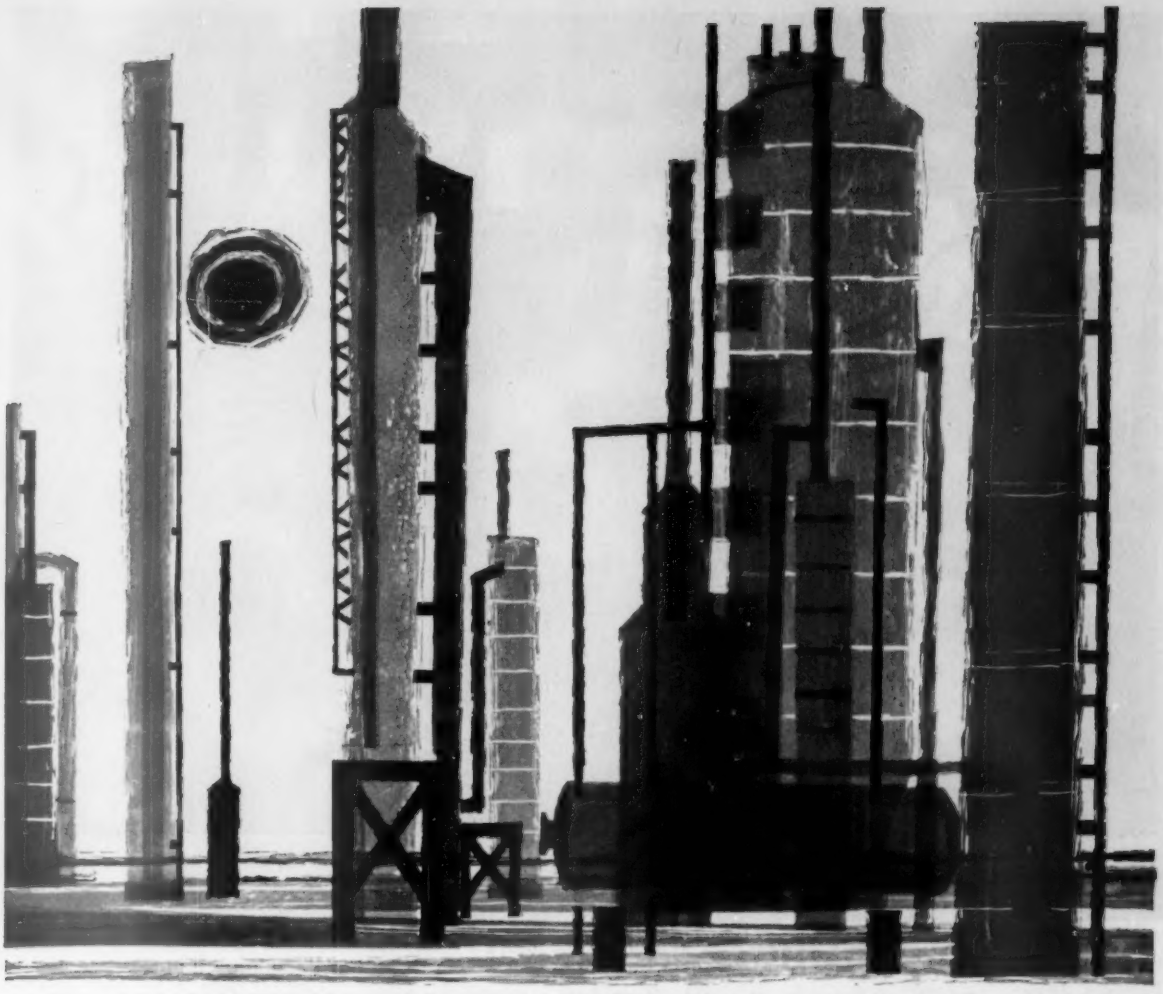

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He's testing slurries of Unaflo cement

This technician is adjusting the potentiometer voltage of a Pan American Tester, during a thickening-time test. In effect, he's reproducing bottom-hole conditions for slurries of Unaflo retarded oil-well cement in accordance with the latest API RP 10B Code.

The simulated temperatures and pressures used in this test procedure (ranging to 300° f and 18,800 psi) are similar to actual cementing operations.

Testing Unaflo cement at varied bottom-hole conditions is a continuing program at Universal Atlas Cement's Research Laboratories. It is your assurance that Unaflo cement will form slurries that pump easily and set hard — under field conditions.

For more information on Unaflo retarded oil-well cement, write Universal Atlas Cement, 100 Park Avenue, New York 17, N. Y.

U-160

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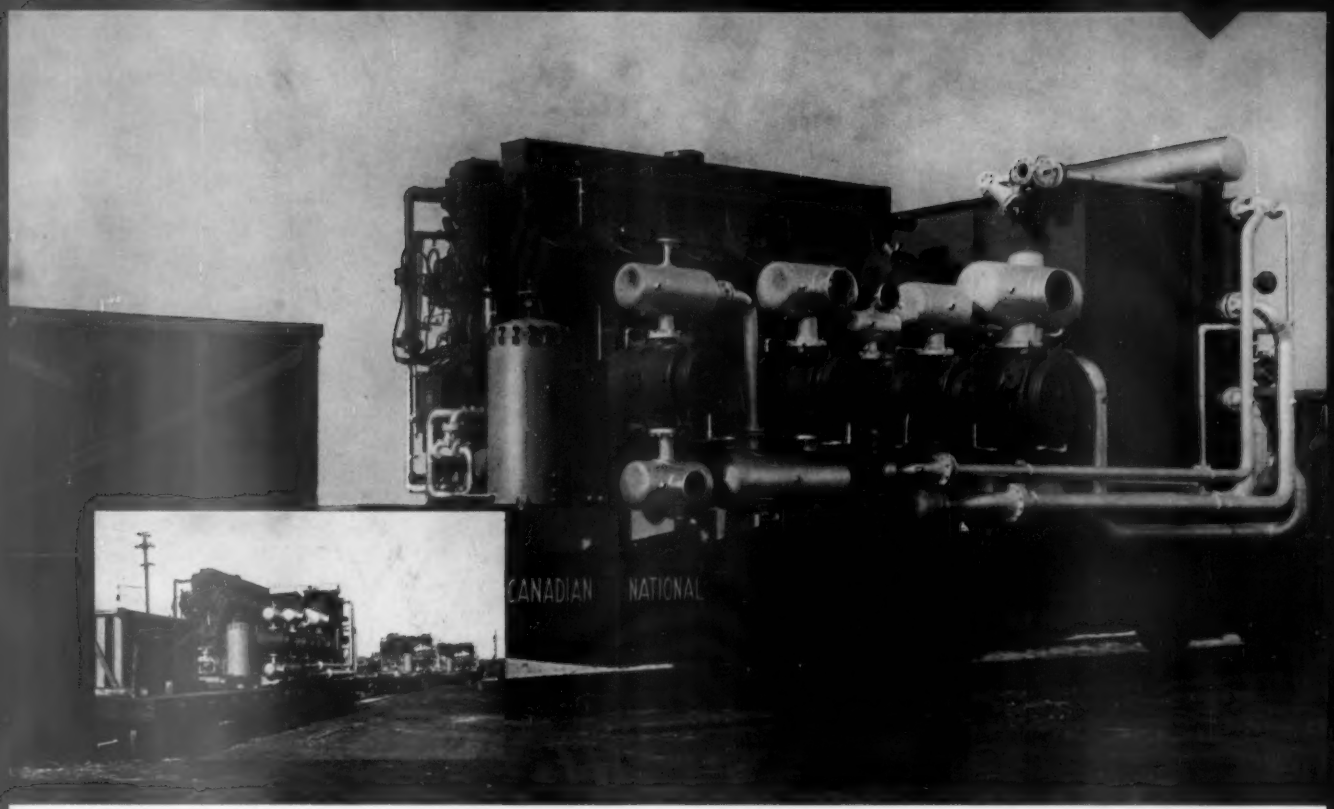
BEAIRD-INGERSOLL-RAND Packaged Compressor Plant

Lowest Cost Per Horsepower Installed



CANADIAN BUILT Beaird-Ingersoll-Rand, 660 h.p. 12SVG packaged compressor units have Young radiators with up-draft air discharge. Interstage gas, engine water and lubricating oil cooling sections are built into the radiator. Other sizes from 120 to 660 h.p.

Beaird Packaged Compressors—

MADE IN CANADA

BEAIRD
another AMF product
PACKAGED COMPRESSOR PLANTS

Packaged Compressors are just one of the many products manufactured by Beaird for the petroleum and petrochemical industries. When you are in the market for new equipment or assistance in developing a specialized product . . . contact Beaird for a qualified appraisal or quotation.

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These three 660 h.p. Beaird-Ingersoll-Rand packaged compressor plants are among the first 18 Canadian-built units to be delivered by Beaird International, Inc., Calgary. This new Beaird subsidiary offers Canadian producers complete sales, service and available manufacturing facilities.

Designed for a major oil company, the units will serve a dual role in gas processing and boosting. Three stages will be used for gas boosting and two stages will handle propane for the chilling process. Another example of the flexibility possible in solving gas production problems, these compressors reflect Beaird's years of design and field experience.

With Canadian facilities, Beaird International offers a single source of responsibility from initial quotation to field service. Beaird offices in Caracas, Venezuela serve South American markets.

Wherever oil or gas is produced, there are skilled Beaird gas engineers to assist in finding an economical solution to your special operating requirements.

THE J. B. BEAIRD COMPANY, INC.
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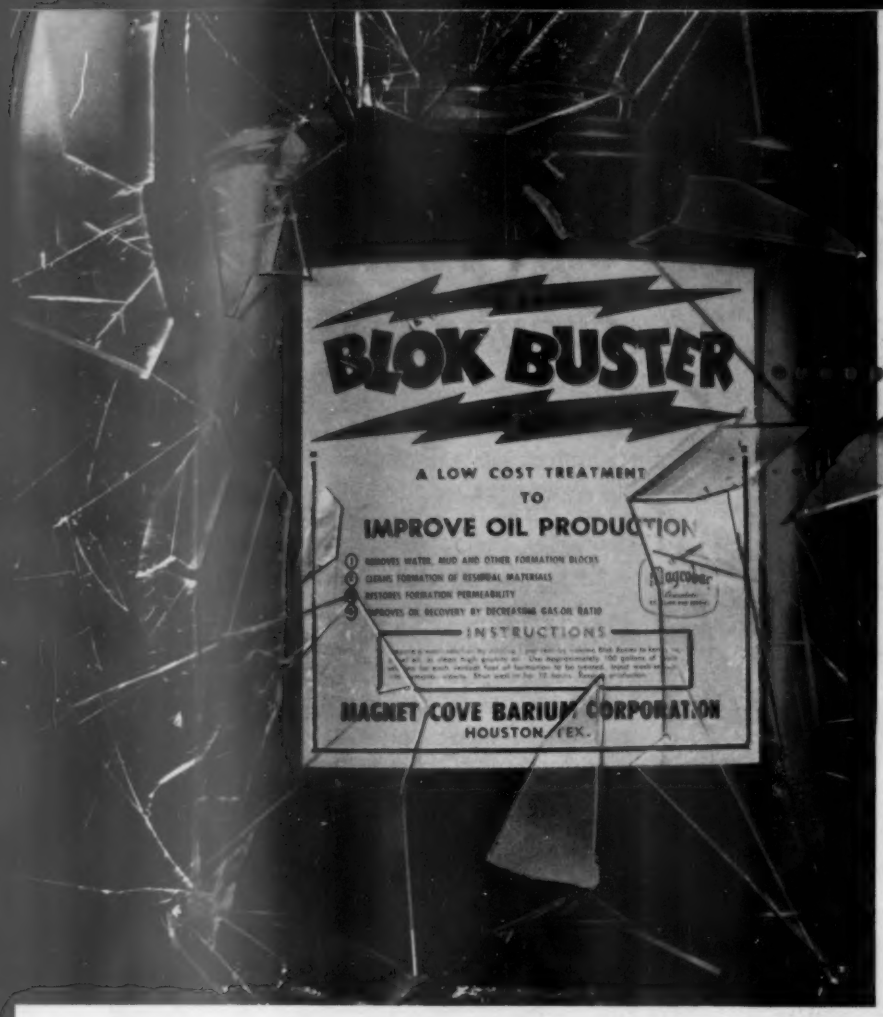


breaks mud, water, and emulsion blocks to increase well production

Blok Buster increased production in these wells

Well did not produce as well as reservoir indicated

Originally produced 10 BOPD from Dakota "J" sands. After a 10-gal. Blok Buster treatment, production was increased to 43 BOPD and is still pumping 36 BOPD five months later.

Well did not resume normal production after workover

Well producing 1 MMCF gas and 30 to 35 bbl. distillate per day from Frio was killed. Following workover, the distillate production was lost. After a 5-gal. Blok Buster treatment, production was increased to 1.5 MMCF and 11 to 14 bbl. distillate per day. Two months later this production is still holding.

Well did not increase following hydraulic fracturing

Well had average production of 5 BOPD and 20 bbl. water. Following fracturing operation, well produced exactly same. Using 35 gal. Blok Buster, production after 21 days was increased to 16 bbl. oil and 11 bbl. water per day.

Blok Buster will open your pay-zones, too, to increased, long lasting production. Here's how it works: Powerful surface-tension reducing agents destroy water blocks in the pores of formations. Powerful dispersants in Blok Buster move clay particles and inorganic solids out of the formation into the well bore. All existing emulsions which might limit production are broken.

But even with this power, Blok Buster can't hurt your well. It won't form emulsions or change the wettability of reservoir rock. It's absolutely non-corrosive, won't damage tubing or well head, will not affect refining operations. Blok Buster is completely soluble in oil and will not form a sludge with reservoir hydrocarbons or water. Plus, Blok Buster is easy and economical to use. The average Blok Buster treatment is only 20-30 gallons — much less than the cost of workovers or acidizing.

Blok Buster is another example of the cost cutting products developed by Magcobar, proof that the right products *used right* on your wells can cut your costs. A Magcobar engineer can advise you on application techniques for your particular production problems. Blok Buster is available in 5-gallon cans from any of Magcobar's 500 stockpoints in the United States and Canada. Elsewhere, write Foreign Operations, P. O. Box 6504, Houston, Texas.

another *well done* with Magcobar Technology

Magcobar
Complete
DRILLING MUD SERVICE

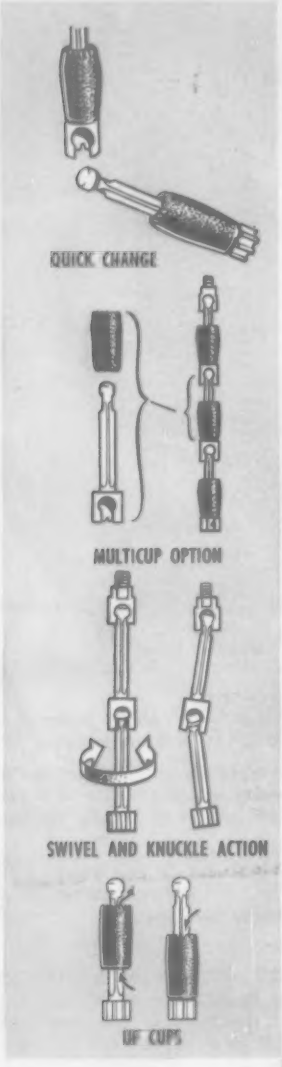
59-2033

MAGNET COVE BARIUM CORPORATION

CUT COSTS.. SPEED-UP SWABBING with NEW

GUIBERSON Knuckle Joint Tubing Swab

and SENSATIONAL MULTI-PURPOSE UF CUPS



QUICK CHANGE — New ball-and-socket design, another Guiberson first, lets you change cups in *ten seconds* with the swab hanging on the line . . you don't even have to lay the swab and sinker bars down. No pipe wrenches or other tools are required. This one feature reduces cost tremendously . . but that's not all . .

MULTICUP OPTION — Add a cup and upper mandrel . . as many as desired. No need to carry several different swabs . . no time lost in changing swabs. There are only five parts in a two cup swab . . sub, cups, upper and lower mandrels. Heat-treated steel parts are individually tested to withstand heaviest swabbing loads.

SWIVEL AND KNUCKLE ACTION— You get full 360° swivel at the bottom socket joint and 5° knuckle action at every joint. With any number of cups and even in crooked tubing, the combination of knuckle action and ample bypass makes this the fastest-falling swab ever run.

UF CUPS — Are strong, flexible, long life . . made from special compound with a valve ring molded in the base. Thus, new valves are obtained each time the swab is redressed. Cups travel freely on the mandrel, allowing bypass inside and outside the cup in the up position . . sealing perfectly in down position. The UF cups, designed especially for the knuckle joint swab, are strongly reinforced for heavy loads . . flexible enough for light loads . . small enough for tight tubing. Use the knuckle joint swab with UF cups and lift more fluid in fewer trips.

SAVE MONEY ON YOUR NEXT JOB WITH THIS SWAB

Sold by OIL FIELD SUPPLY STORES EVERYWHERE

SAFE THAN SORRY — GUIBERSON — BETTER BE

THE

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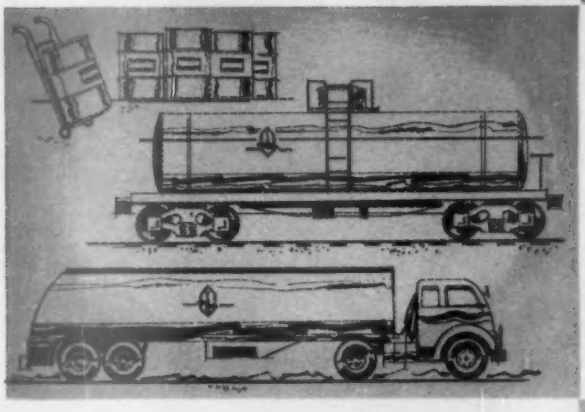
ESTABLISHED 1919 — DALLAS, TEXAS U. S. A.

Gas Processors get all three from Jefferson!

THE RIGHT CHEMICALS . . .

for efficient Natural Gas Sweetening, Refinery Stream Sweetening, Sulfur Recovery, Solvent Extraction, Carbon Dioxide Absorption, Gas Dehydration, and Hydrate Prevention.



ON-SCHEDULE DELIVERIES . . .

when and where and in any quantities you require . . . 55-gal. drums, 1-4,000-gal. tank wagons, 4-10,000-gal. tank cars . . . single product or combination shipments.

HELPFUL TECHNICAL SERVICES . . .

like those relating to proper storage and handling, or complete analyses of your gas-scrubbing agents, or just any way the Jefferson people can help you lick a problem. Your request to 1121 Walker Avenue, Houston 2, Texas, will bring helpful answers on the double.

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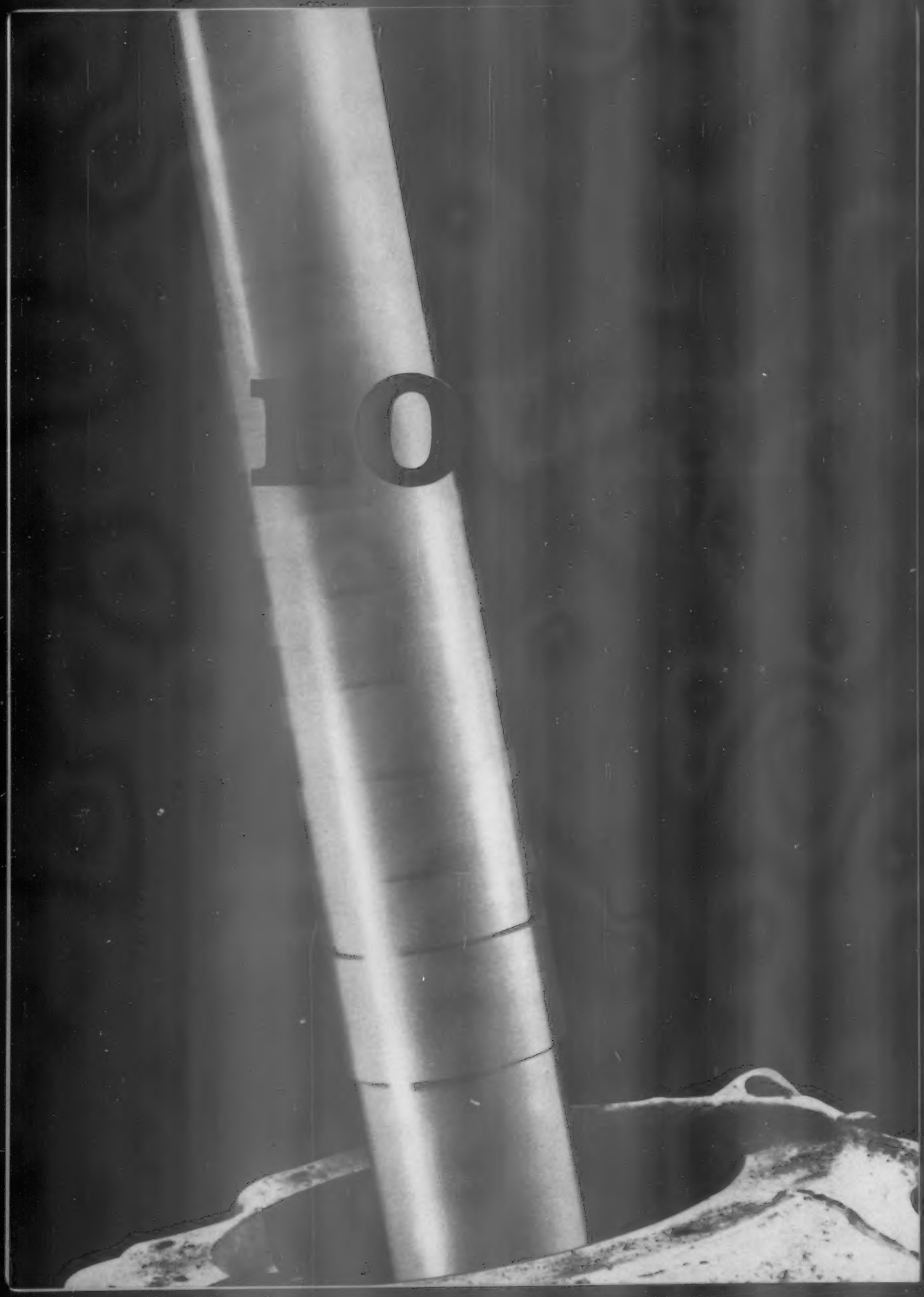
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This pipe gives you the uniformly high yield strength, the positive roundness, the maximum "right" amount of metal under thread roots. You lower in with greater resistance to pull-out, greater resistance to collapse!

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SPECIFY REPUBLIC. Electric Weld or Seamless. Fast delivery from mill or distributor stocks.

REPUBLIC STEEL
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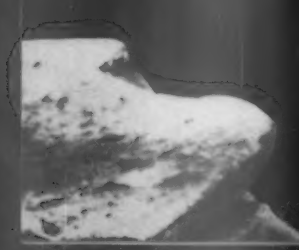
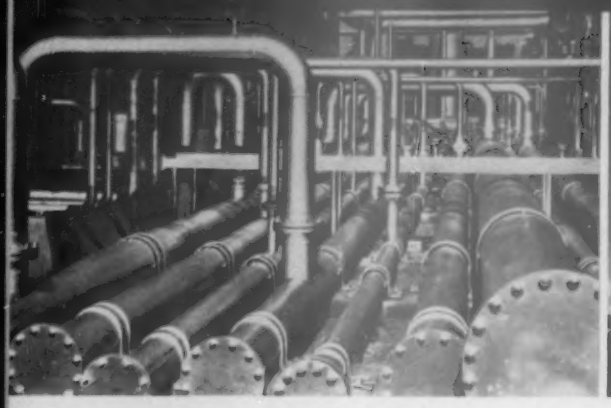
World's Widest Range of Standard Steels and Steel Products



from REPUBLIC



Powerful Clamping Action...

Republic Alloy Studs and Hex Nuts provide safe, leak-proof performance on high-pressure applications. Studs are usually furnished in AISI 4142 Chrome-Moly Steel, heat treated to ASTM A 193, designation B 7, or in designations B 14 and B 16 for higher temperatures. New folder has complete information.

Better Field Welds...

No danger of burn-through when the line pipe is Republic Electric Resistance Weld. Made from prime, flat-rolled carbon steel. Checked for defects and uniformity as only *flat-rolled* steel can be checked. Uniform roundness, wall thickness, and concentricity assure faster line-up of joints, better field welds. High ductility makes for trouble-free bending in field or shop.

Higher Strength-To-Weight...

Outstanding strength-to-weight ratios with the highest strength values make Republic Alloy Steels ideal for use in gears, shafts, bearings, tools, and drilling bits. Uniform response to heat treatment assures complete deep-hardening penetration, plus hard, wear-resistant surfaces. Return coupon for more information.

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- ☐ Alloy Steels
- ☐ Alloy Steel Studs and Hex Nuts
- ☐ Republic Line Pipe

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REPUBLIC STEEL

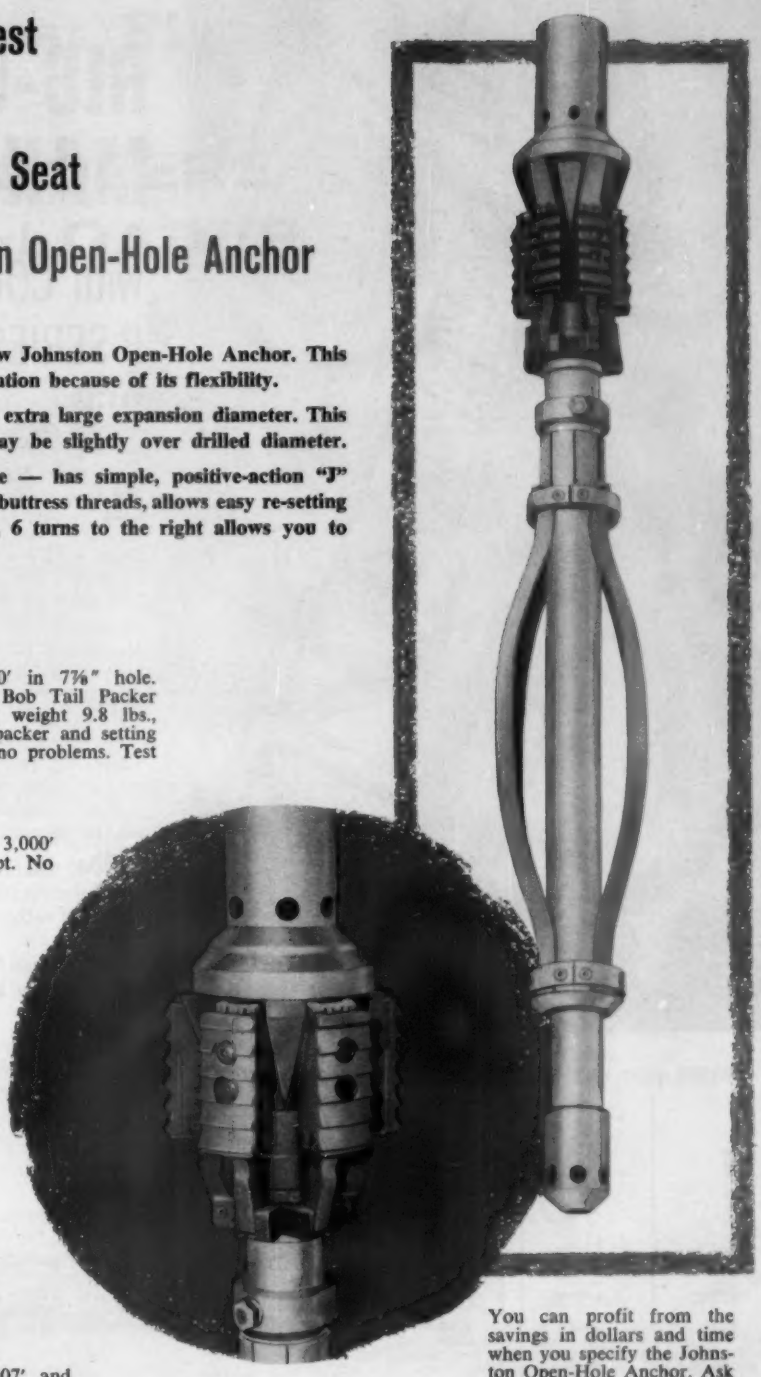
To Open-Hole Straddle Test
Eliminate Tail Pipe
Insure a Good Packer Seat

specify the new Johnston Open-Hole Anchor

Many advantages are offered with this New Johnston Open-Hole Anchor. This is a slip-type device which has wide application because of its flexibility.

The slips are designed and built to give an extra large expansion diameter. This insures seating in wells where the hole may be slightly over drilled diameter.

The Open-Hole Anchor is easy to operate — has simple, positive-action "J" setting. A spring locking nut, incorporating buttress threads, allows easy re-setting of the anchor. When testing is completed, 6 turns to the right allows you to rotate out of the hole.



THE PROOF---

Hansford County, Texas
Conventional test at 8800′ in 7⅞″ hole. Used Anchor and single Bob Tail Packer only. No tail pipe. Mud weight 9.8 lbs., estimated 120,000 psi on packer and setting tool. No slipping of tool, no problems. Test successful.

Hansford County, Texas
Straddle test in 7⅞″ hole between 3,000′ and 4,000′. Anchor set on first attempt. No wash pipe used. Test successful.

Hansford County, Texas
Straddle test in 7⅞″ hole between 6,000′ and 7,000′. Tool set on first attempt. No wash pipe used. Test successful. Second test run between 5,000′ and 6,000′. Packer failed to seat in washed out hole. Moved up hole, tool and packer set on first attempt.

Hansford County, Texas
Straddle test in 7⅞″ hole between 5,000′ and 6,000′. Tool set on first attempt. No wash pipe used. Test successful.

Liberal, Kansas
Straddle test between 5,006′ and 5,016′. Tools worked well. No trouble. No wash pipe used. Test successful.

Liberal, Kansas
Selective zone tests between 3,907′ and 3,915′ and 4,672′ and 4,680′. No problems encountered. Tools worked perfectly. No wash pipe. Test successful.

Liberal, Kansas
Two straddle tests run between 4,662′ and 4,678′ and 4,577′ and 4,614′. Both tests O.K. No trouble whatsoever. Tools worked as expected. Test successful.

You can profit from the savings in dollars and time when you specify the Johnston Open-Hole Anchor. Ask your Johnston representative for full information. You'll be glad you did.

Eliminates the need for tail pipe on conventional tests and straddle tests.

Offers flexibility in finding packer seat. If seat is not obtained on initial attempt just pick up and re-set the tool.

JOHNSTON DRILL STEM TESTING TESTERS

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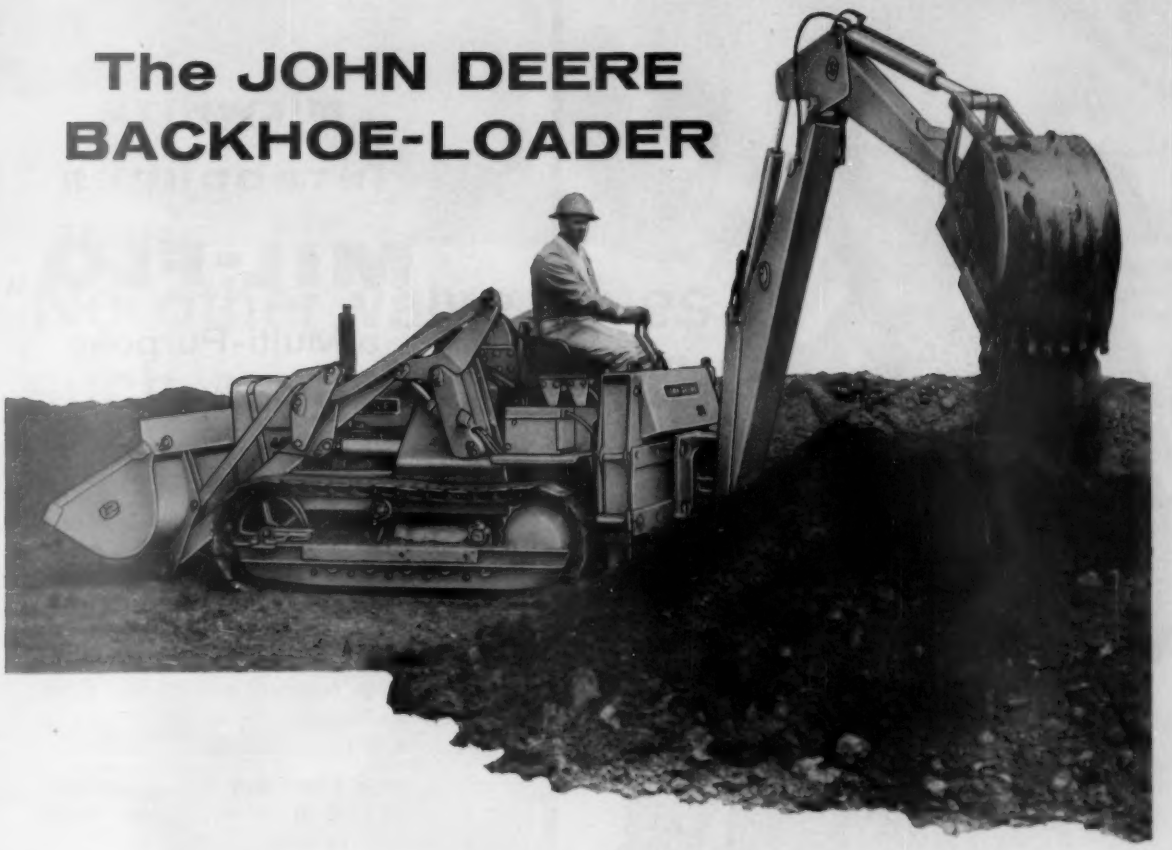

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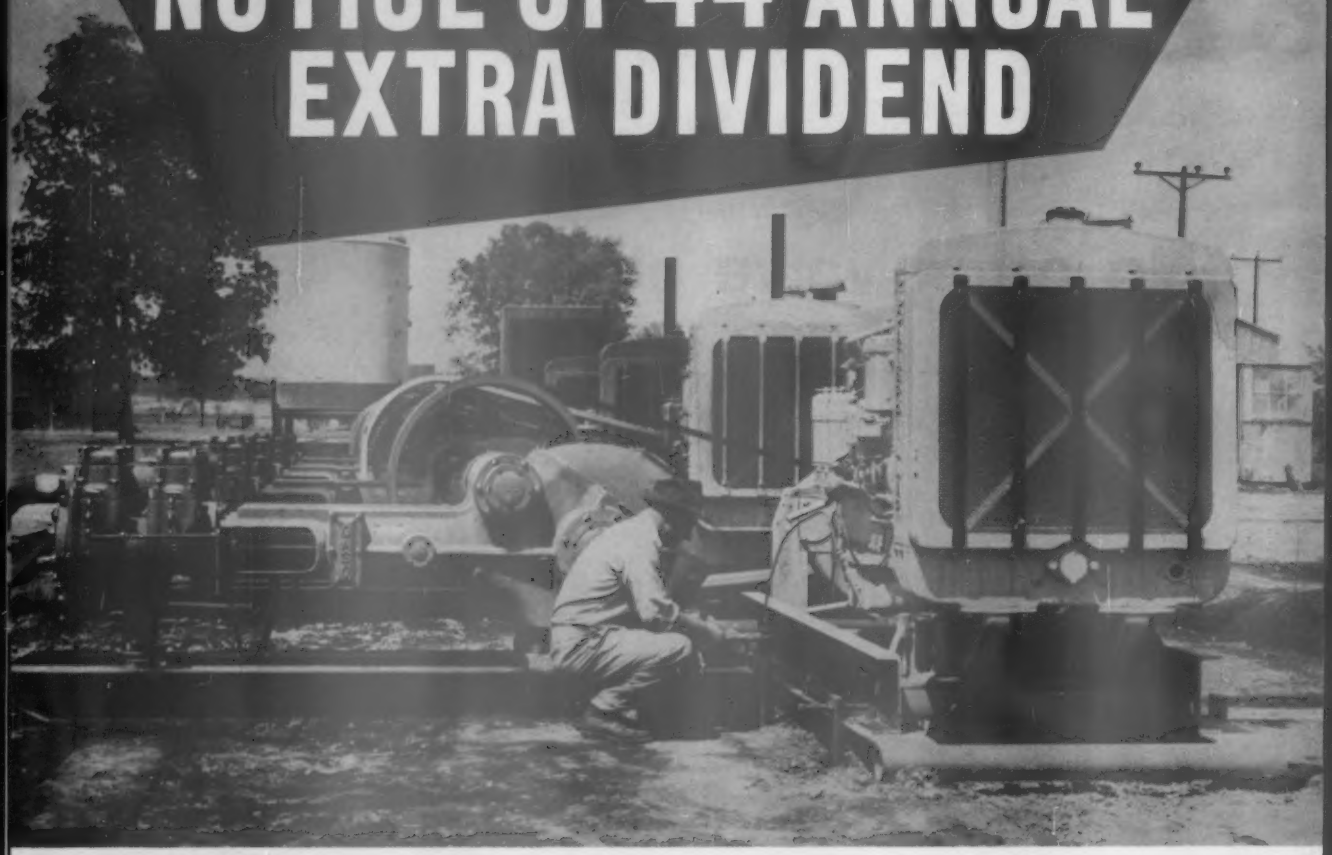

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SERIES 3600

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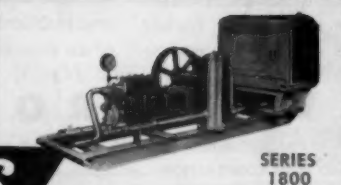

SERIES 1800

Fig. 1849 takes 2½" to 4" pistons and operates with pressures from 900 to 350 psi. Fig. 1847 takes 2½" to 4½" pistons and operates with working pressures from 900 to 275 psi.

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for every oil industry need

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GUESSWORK AND HUNCHES OUT IN PRESENT-DAY BUYING PRACTICE

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Today efficiency-conscious management insists on the selection of pumps which, through investigation, prove to measure up in greatest degree to the concept of maximum performance per dollar expended.

These facts were brought out in a study of recent sales by Gaso Pump & Burner Manufacturing Co. Among the yardsticks used to govern pump selection are:

Completeness of line, assuring models and types best suited to specific conditions.

Performance record, embracing a study of service, service life, operating and maintenance costs.

Responsibility of manufacturer.

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use CF&I-Wickwire *Double Gray*

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another fine product by

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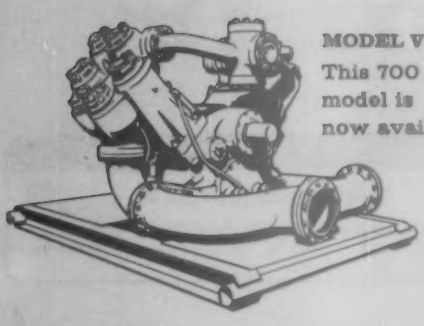
proved in

These 1500-H.P. models, Model V1500, have been in actual deep, high pressure drilling service in Louisiana, Texas Gulf Coast, Rocky Mountain area, and Alaska for many thousands of hours.

MODEL V1500



MODEL V700
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A 400-H. P. model will be in production in the near future.

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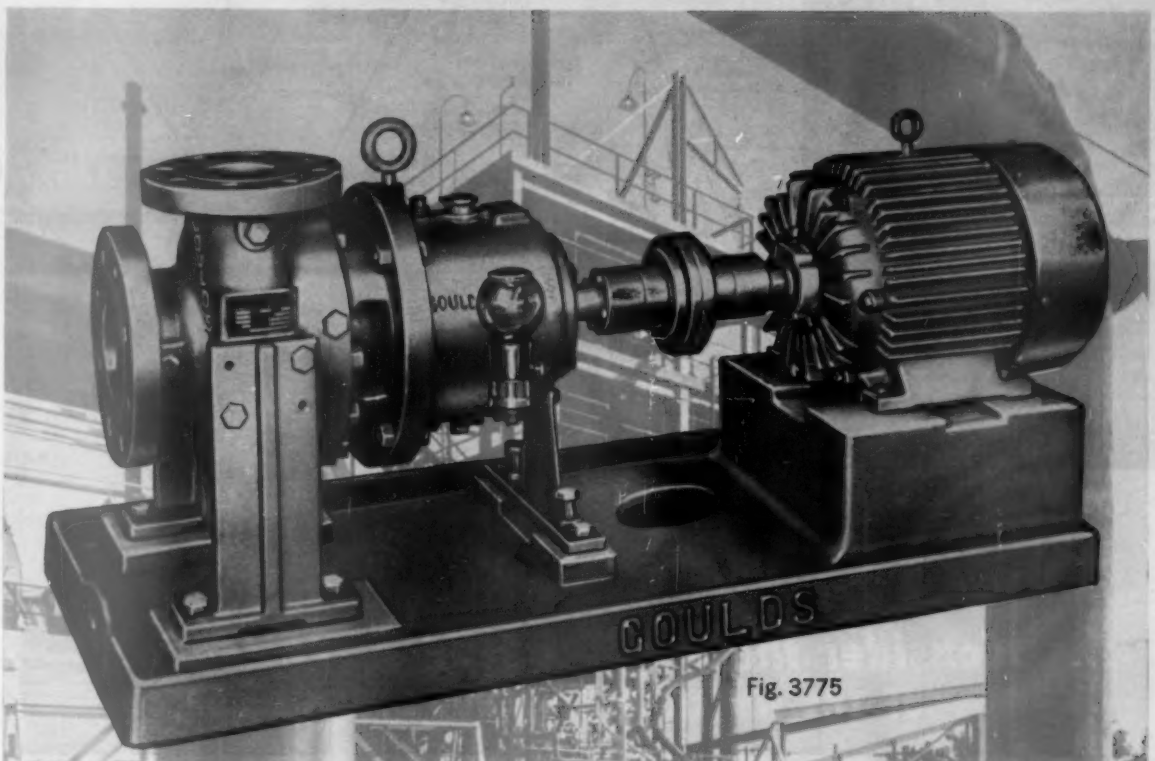

Fig. 3775

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SISTER PUMP . . . Goulds Fig. 3675, a unique close-coupled model, installs in any position.

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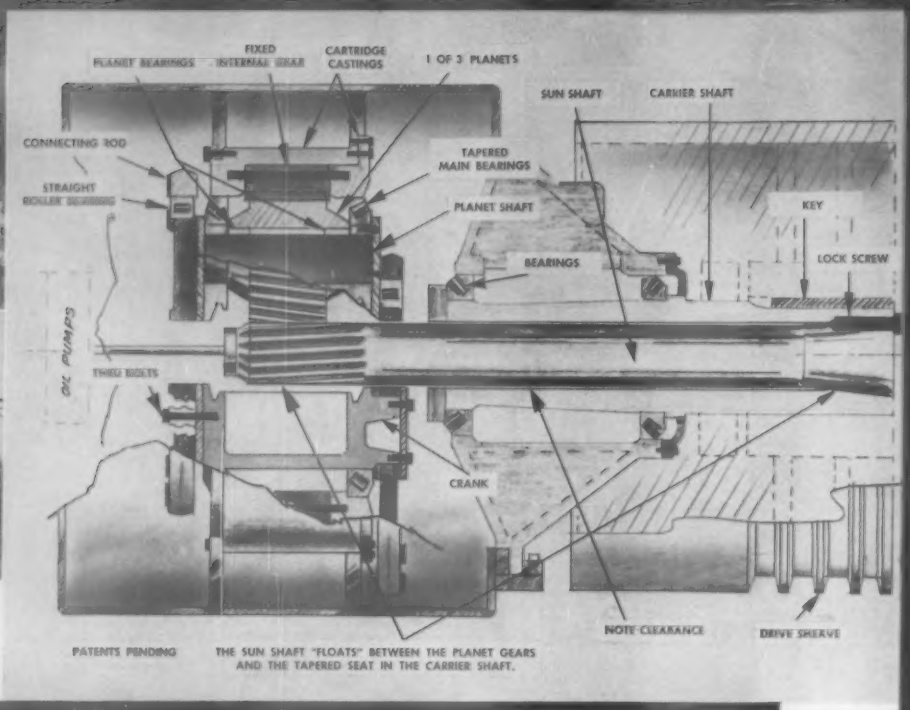

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U. S. Patent 2,649,988 and 2,717,186. Other patents pending.

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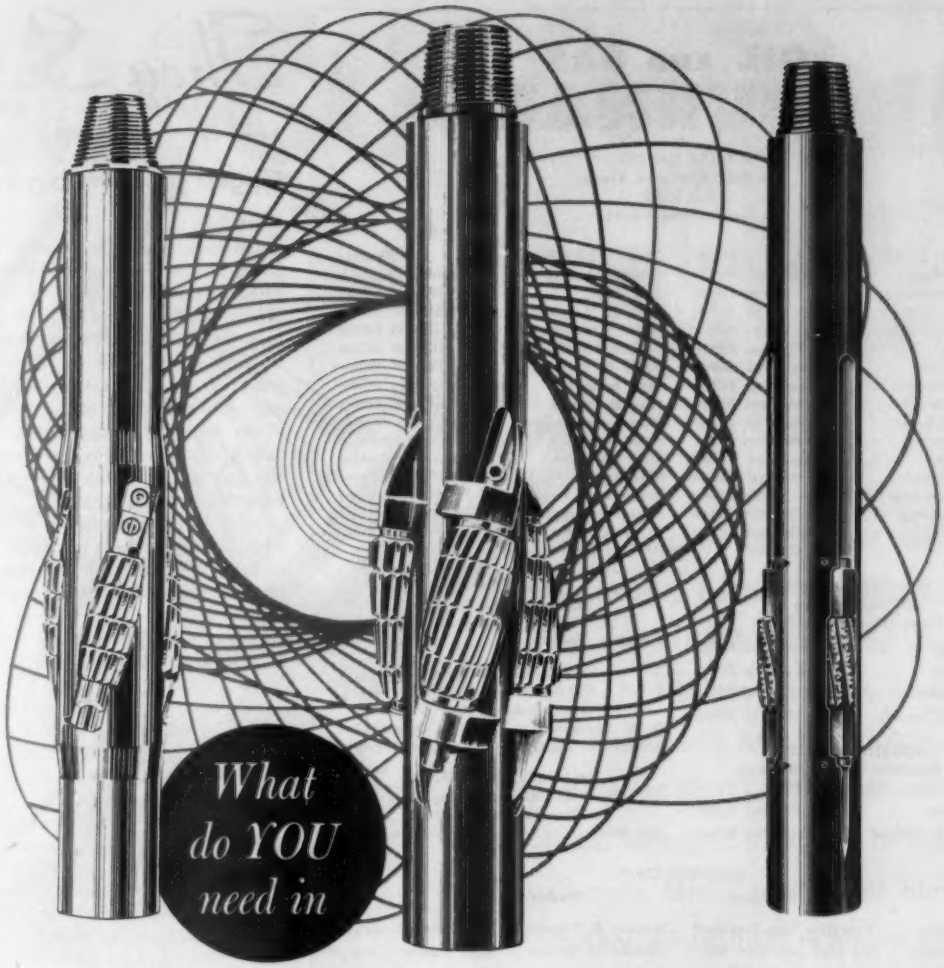

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They Say—

Biggest problem: big hogs

Dear Sir:

On page 57 of the issue of July 13 is an article by Henry D. Ralph entitled "Could This Be?" It views the oil industry in the year 2059 and tells how the government took over the oil business from 1959 on. This is supposed to be a fairy tale, but is probably too near the truth.

On page 59 is an editorial entitled "Oversupply Explains the Urge to Tie Up Markets." Toward the end of the editorial is this sentence: "The real cure is for the growth of demand to overtake the growth of supply."

Both of these articles remind me of an idea which I have thought about for some time. It is this: Is it not a fact that these troubles of the oil industry are due to hogs—two-legged hogs I mean?

All restrictive legislation has come about for the same reason. There were hogs and pirates in the stock market, so we were saddled with the Securities Exchange Commission.

Instead of showing some sense and self-restraint, the oil business overproduced in the United States and then, in order to save a few cents, began pouring oil in from abroad.

Instead of having an automatic control by tariffs, which are provided for in the Constitution, we go to controls which are not provided for in the Constitution. This naturally leads to personal regulation and probably will lead to control as outlined by Henry D. Ralph.

Excesses are now national in scope and can lead to the suppression of free enterprise.

Since we believe in free enterprise, which means responsibility as well as freedom and opportunity, let's exercise self-restraint and thus avoid government control.

As Shakespeare said, "What fools these mortals be."

George W. Nilsson
Lawyer
Los Angeles.

Required reading

Dear Sir:

In the June 29 issue of The Oil and Gas Journal (p. 35) Henry D. Ralph's "Journally Speaking" carried an item entitled "Alligator Eggs" which discussed the function of oil

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A Pipe Yard At Lignite, North Dakota.

Here's how they **keep mud moving** *on "Mister Cap"*

Mounted directly above the mud tank—with its steel shaft reaching down into the mud—is a LIGHTNIN Mixer.

At the bottom of the turning shaft, a big turbine-type impeller drives the mud in a steady, powerful flow. All through the tank, mud keeps mixing, interchanging, equalizing. It doesn't settle out. It's always in condition. And if necessary, mud weight and viscosity can be changed at the drop of a hat.

This is what you'll see aboard "Mister Cap," the 4000-ton all-electric offshore mobile drilling barge that brought in its first producer in just eight days—and has been meeting its owners' expectations ever since as a model of drilling efficiency.

You can get faster, safer, more productive drilling with LIGHTNIN Mixers on *your* rigs. Fewer stops. No long waiting for mud to get into condition. Surer protection against blowouts.

Cut pump maintenance cost, too. When you have LIGHTNIN Mixers you don't have to use your standby pump for jetting mud. It's always instantly available for use on the hole.

See for yourself why so many offshore and land rigs use this simple, fast way to control mud. Ask your LIGHTNIN Mixer representative to set up a visit to one of these rigs in your area. Call him today (he's listed in Composite Catalog). Or write us direct.

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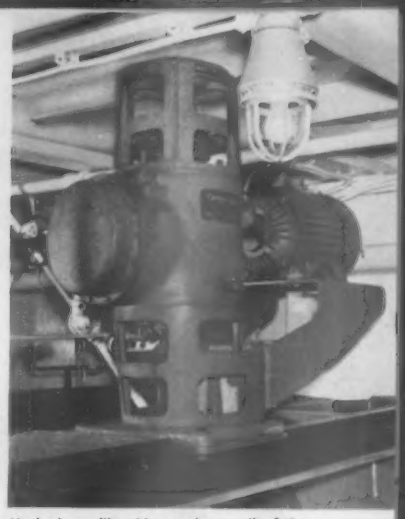

Mud mixers like this one keep all of the mud in suspension, with uniform gravity and viscosity.

THREE-LEGGED JOB-HOPPER "Mister Cap" spudded and drilled its first producing well in 8 days; has worked steadily in the Gulf since November 1957. Built by R. G. LeTourneau Inc., the barge is owned and operated by Barnwell Offshore, Inc.

marketing within the petroleum industry.

We feel that his points were so clearly and concisely made that we would like to obtain permission to reproduce the article in the August issue of our magazine, ESPA.

We would like to preface our presentation with this explanation:

"Over the past several months there has been increasing interest shown within the oil industry concerning the problem of intra-industry communication. Oil men have become acutely aware of the need not only to make the operation of the entire industry clear and understandable to the public at large, but, in addition, to explain their own field of operation to other oil men working in a different area.

"In the June 29 Oil and Gas Journal we found one of the finest summaries of oil marketing's role in over-all industry operations we have yet seen. We believe it should be required reading in the nonmarketing segments of the industry."

Congratulations to Mr. Ralph on a fine job.

Stewart O'Neill
Associate Editor
Empire State Petroleum Association, Inc.
New York

Cost story profitable

Dear Sir:

This is in reference to your special pipeline report, which I read with much interest and profit ("Pipeline Costs Vary All Over the Map," OGJ, June 13, p. 89).

Would it be possible to send me a copy of the underlying figures from which Figs. 1, 2, and 4 were drawn?

Also, am I correct in thinking that the line labeled "1948 costs adjusted for BLS index" means the figure as it would be if it had increased by exactly the same percentage as the index?

M. A. Adelman
Department of Economics and Social Science
Massachusetts Institute of Technology

(Editor's note: Underlying data for Figs. 1, 2, and 4, pages 90 and 92, are derived from Interstate Commerce Commission annual reports. Reader Adelman is correct in assuming that the line, "1948 costs adjusted for BLS index" means the figure as it would be if it had been increased exactly the same percentage as the index.)

Congratulations!

Dear Sir:

Just a note to let you know how much I enjoyed your article on pipeline costs. I think you have done a wonderful job and are to be congratulated.

Clare G. Miller
President
M. G. Crose Manufacturing Co., Inc.

Send extras, please

Dear Sir:

We would very much appreciate receiving 10 copies of your report on pipeline costs.

Our people at the Esso Research center are continually looking for information on this subject, and it will be extremely helpful to us to have these copies.

H. C. Cook
Pipeline Research
Esso Research & Engineering Co.

Booming B. C.

"The discoveries in northeastern British Columbia have stimulated such an interest that one of the greatest

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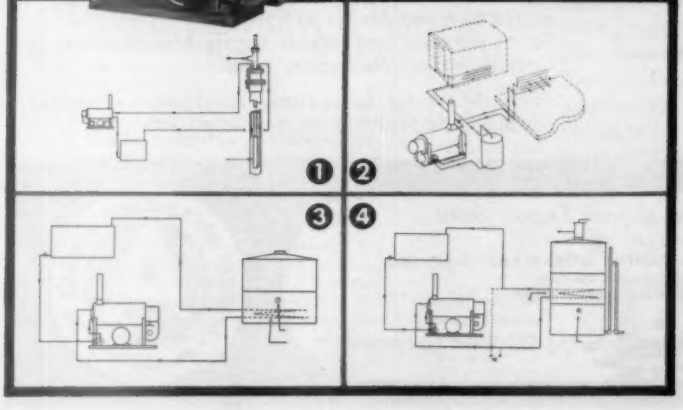
Be sure to get complete information on the Texsteam BTU Thermal Unit before specifying any type of heat transfer installation. Ask your Texsteam representative or write for bulletin.



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land plays in its history commenced late last year.

"Major and independent oil companies since then have acquired more than 50 million additional acres in the large sedimentary basin in this and adjacent areas."

Frank M. McMahon, president, Westcoast Transmission Co., Ltd., in a statement in the company's annual report.

Battle of the budget

"I've heard people say it takes courage to raise taxes. The real courage we need in this country is the courage to cut expenditures."

Frank O. Prior, chairman of the board, Standard Oil Co. (Ind.), in an article in the Chicago Tribune.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

AUGUST

10-13 Society of Automotive Engineers, national West Coast meeting. Hotel Georgia, Vancouver, B. C.

14 Southern Gas Association, transmission management conference, Sheraton-Dallas Hotel, Dallas.

10-28 Louisiana Polytechnic Institute, Lou-Ark section of AIME, graduate summer session in reservoir engineering, Louisiana Polytechnic Institute, Ruston, La.

12-15 Billings, Mont., Geological Society, tenth annual field conference, Disturbed Belt area of northwestern Montana, registration, August 12, Great Falls, Mont.

18-21 Western Electronic Show and Convention, San Francisco.

23-26 American Institute of Electrical Engineers, sixth electrical conference of the petroleum industry, Wilton Hotel, Long Beach, Calif.

24-25 North Dakota Oil and Gas Association, annual meeting, Grand Pacific Hotel, Bismark, N.D.

24-26 West Virginia University, annual Appalachian gas measurement short course, Morgantown, W. Va.

26-27 Petroleum Symposium, "The Next 100 Years," University of Houston, Houston.

26-28 Pennsylvania Grade Crude Oil Association and Pennsylvania State University, twenty-first technical conference on petroleum production, Penn State campus, University Park, Pa.

27 Oil Centennial Day, Titusville, Pa.

SEPTEMBER

3-5 Northwestern International Oil Scouts Association, annual meeting, Prince of Wales Hotel, Waterton National Park, B. C.

9-11 American Society of Mechanical Engineers, American Society of Civil Engineers, West Coast conference of applied mechanics, Stanford, Calif.

9-11 Pacific Coast Gas Association, an-

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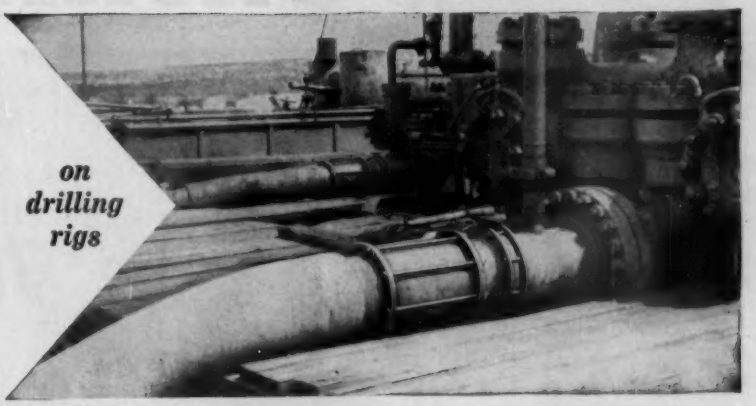

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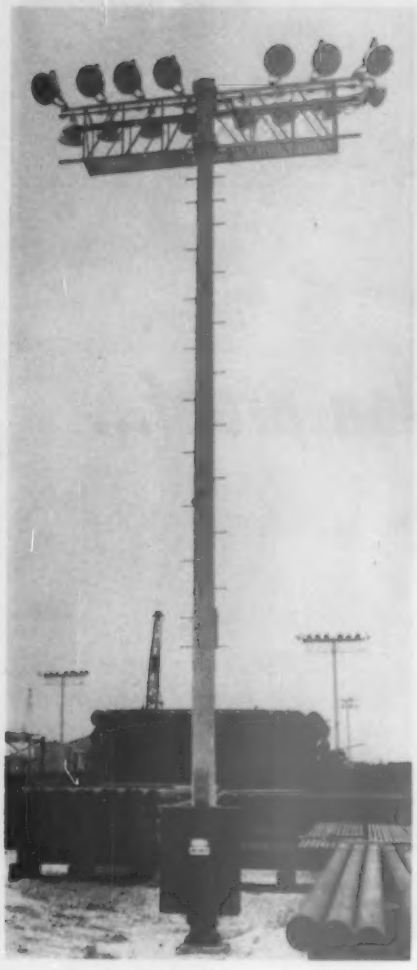

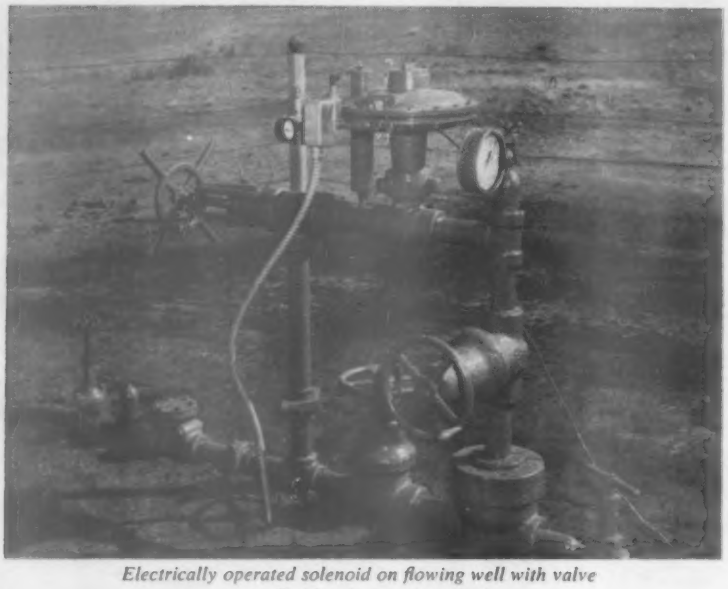

Electrically operated solenoid on flowing well with valve controlled by electric time-clock.

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nual meeting, Ambassador Hotel, Los Angeles.

9-12 Intermountain Association of Petroleum Geologists, annual field conference, western high Uintas, registration, September 9, Provo, Utah.

10-12 Magic Plains Oil Exposition, Borger, Tex.

14 American Petroleum Institute, University of Texas, seventh session of school of pipeline technology, Lee College, Baytown, Tex.

14-16 Texas Mid-Continent Oil and Gas Association, annual meeting, Rice Hotel, Houston.

15-16 American Gas Association, Southern Gas Association, eleventh annual accident prevention conference, Dinkler Plaza Hotel, Atlanta.

16-18 Wyoming Geological Association, field conference, Big Horn Basin, registration, Cody, Wyo.

16-18 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

17 Natural Gasoline Association of America, Rocky Mountain regional meeting, Wyoming-Gladstone Hotel, Casper, Wyo.

20-23 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Rice Hotel, Houston.

21-23 Columbia University, oil refinery workshop on passive element analog computers, Engineering Building, Columbia University, New York.

21-25 Instrument Society of America, annual instrument-automation conference and exhibit, International Amphitheater, Chicago.

23-24 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

24-25 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division annual meeting, Roosevelt Hotel, New Orleans.

27-29 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Leamington, Minneapolis.

27-30 American Institute of Chemical Engineers, national meeting, Hotel St. Paul, St. Paul.

29-30 Western Petroleum Refiners Association, management seminar, Western Hills, Waggoner, Okla.

28-Oct. 1 American Welding Society, fall meeting, Sheraton-Cadillac Hotel, Detroit.

29-Oct. 1 National Association of Corrosion Engineers, western region conference, Bakersfield Inn, Bakersfield, Calif.

OCTOBER

1-2 National Association of Corrosion Engineers, southeast region conference, Jacksonville, Fla.

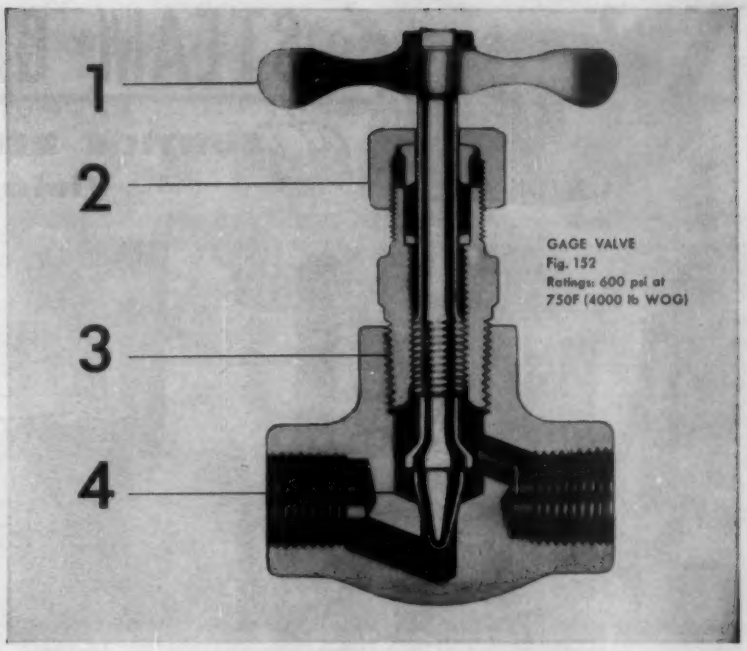
2-3 Association of Desk and Derrick Clubs of North America, eighth annual convention, Hilton Hotel, San Antonio, Tex.

4-7 Society of Petroleum Engineers of AIME, fall meeting, Memorial Auditorium, Dallas, Tex.

5-7 American Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.

5-7 National Association of Corrosion Engineers, northeast region conference, Lord Baltimore Hotel, Baltimore.

5-10 Society of Automotive Engineers, national aeronautic meeting, air-



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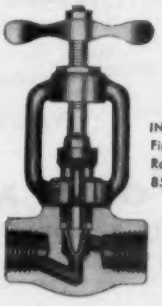

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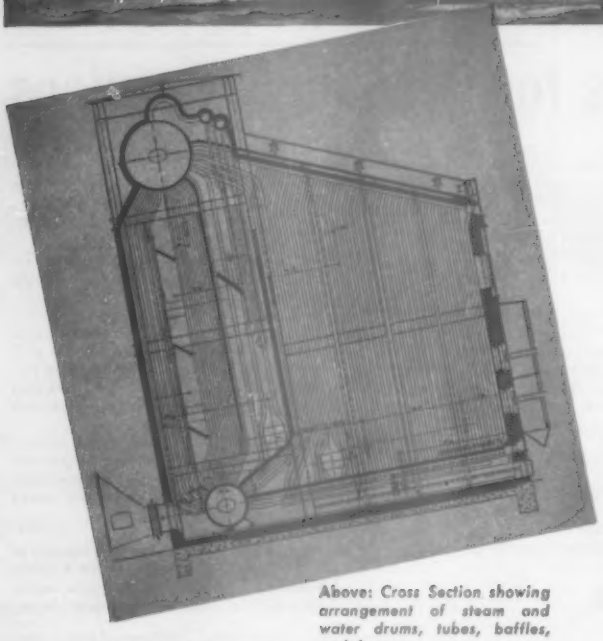

Above: Cross Section showing arrangement of steam and water drums, tubes, baffles, and furnace.

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craft manufacturing forum, and aircraft engineering display, The Ambassador, Los Angeles.

7-8 Western Petroleum Refiners Association, fourth annual stream pollution and waste disposal conference, Broadview Hotel, Wichita.

7-10 Rocky Mountain Association of Geologists, eleventh annual field conference, Saratoga Inn, Saratoga, Wyo.

8-9 California Natural Gasoline Association, annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif.

8-10 American Association of Petroleum Geologists, Southwestern Federation of Geological Societies, second annual regional meeting, Coliseum, Lubbock, Tex.

8-10 Exploration Drilling symposium, sponsored by University of Minnesota, Colorado School of Mines, and Pennsylvania State University, University Park, Pa.

8-11 Louisiana Gulf Coast Oil Exposition, Lafayette, La.

11-13 American Association of Oilwell Drilling Contractors, annual meeting, Skirvin Hotel, Oklahoma City.

11-16 American Society for Testing Materials, Pacific area national meeting, Sheraton-Palace Hotel, San Francisco.

12-15 National Association of Corrosion Engineers, south central region conference, Cosmopolitan Hotel, Denver.

13-14 Seventh Annual Gas Measurements Institute, National Guard Armory, Liberal, Kans.

20-22 American Standards Association, national conference on standards, Sheraton-Cadillac Hotel, Detroit.

20-22 National Association of Corrosion Engineers, north central region conference, Cleveland.

20-22 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Sheraton-McAlpin Hotel New York.

22-23 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin section, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

23 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

26-27 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

26-27 Independent Natural Gas Association of America, annual meeting, Westward Ho Hotel, Phoenix.

26-28 Society of Automotive Engineers, national transportation meeting, La Salle Hotel, Chicago.

28-29 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28-29 Armour Research Foundation of Illinois Institute of Technology, annual computer applications symposium, Morrison Hotel, Chicago.

28-30 Society of Automotive Engineers, fuels and lubricants meeting, La Salle Hotel, Chicago.

28-30 American Association of Petroleum Geologists, Mid-Continent regional meeting, Broadview Hotel, Wichita.

29-30 Oil Recovery Symposium on Southwest Texas, sponsored by southwest section of AIME and Texas Petroleum Research Committee, Driscoll Hotel, Corpus Christi, Tex.

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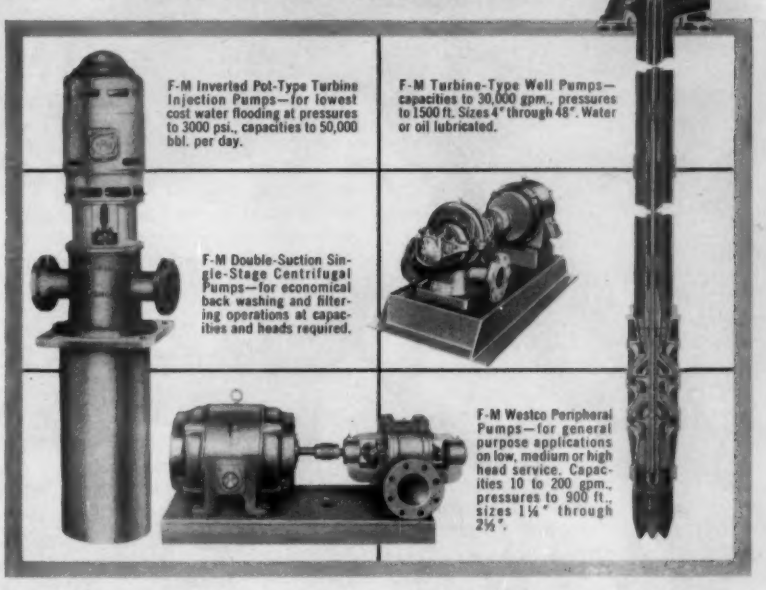

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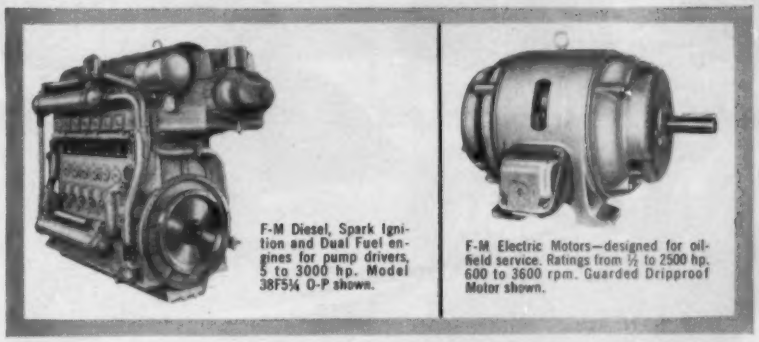

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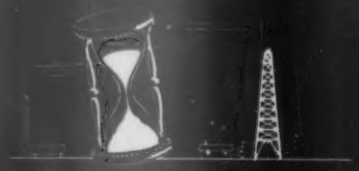


the Journal said...

50 years ago

August 6, 1909

Pioneer oil men from all parts of the country return to Bradford, Pa., to celebrate Old Home Week and semicentennial anniversary of the Drake discovery well near Titusville in 1859. Western Pennsylvania Pipe Line Association sponsors celebration outing at Conneaut Lake.

Gulf Pipe Line Co. and J. M. Guffey Petroleum Co. complete plans for three-story office building at Beaumont, Tex., company headquarters.

Recently organized Standard Oil Co. of Louisiana starts handling refined-oil business in Louisiana previously supplied through Standard Oil Co. of Kentucky.

Alpine Oil Co., owned by Harry Sinclair and P. J. and Tom White, sells nine 55,000-bbl. steel tanks of oil in the Flatrock district, north of Tulsa, to The Texas Co. in one of the biggest single oil deals of recent months. Payment is 33 cents per barrel for the oil and 17 cents per barrel for the tanks.

25 years ago

August 9, 1934

British parliament passes bitterly fought Government Petroleum Act vesting ownership of country's oil and natural gas in the Crown. Opponents denounce act as "gift to socialism".

Completion this week of two prolific oil producers, one by W. A. Delany and J. C. Shaffer, and the other by Crosbie & Moran, converts Oklahoma's disappointing Fitts area, in Pontotoc County, into major field prospect.

Great Lakes Pipe Line Co. uses newly completed products line to pump 500,000 to 750,000 gal. of fresh water daily from Kansas City to drought-stricken communities along the line as far as Des Moines.

10 years ago

August 11, 1949

Standard Oil Co. of New Jersey announces suspension of all imports of Middle East crude oil. Shipment of 110,000 bbl. of Kuwait crude unloaded this week is last under contract with Anglo-Iranian Oil Co.

Mid-Valley Pipeline Co. awards contracts for laying 847 miles of its proposed 1,000-mile, $56,000,000, 20 and 22-in. crude oil line from Longview, East Texas, to Lima, Ohio.

First shipload of materials and equipment for starting construction of western end of 1,067-mile Trans-Arabian pipe line leaves Houston for Beirut, Syria.

JOURNALLY SPEAKING

Easy Glum, Easy Glow

WE WISH we'd said that. We heard it attributed to the economist of a major oil company. But even though we didn't originate it we're going to use it, because it's such a pat description of the oil industry's psychology: Easy glum, easy glow.

It seems that oil men are always either riding the crest of optimism or else slogging along in the dumps—and that they swing from one state of mind to the other at the slightest provocation.

Just let there be a cold snap up north so that the demand for heating oil is brisk for a couple of weeks, and the industry starts to glow—expanding its drilling programs, upping its refinery runs, and planning on a big growth in business all over.

But just let the price of crude oil or of gasoline drop a few cents a barrel in some areas and the industry gets glum all over—predicting a decline in consumption, permanent overproduction, and general depression.

'Twas ever thus. Back in the old days whenever a big new wildcat came in the price of oil hit the skids because everybody figured this meant oversupply. But a rumor that some producing well was losing pressure or going to salt water would send prices skyrocketing.

The industry never got over this easy-glum-easy-glow way of thinking. Any straw in the wind seems to change smiles to frowns or vice versa.

Just look back over almost any period of time and you'll agree that either oil men were all happy as larks, sitting on top of the best of all possible worlds and headed for prosperity unlimited; or else they were plunged in the depths of despondency, their business headed straight for the dogs and no possible way to avoid utter disaster.

It would seem that the oil business—or at least the oil man's view of the oil business—is never just so-so. It's like the little girl who had a little curl right in the middle of her forehead—when it's good it's very, very good, but when it's bad it's just simply ghastly.

Take just this last spring. When import controls were imposed everybody (except maybe the former importers) began to glow and glow. They figured: "Boy, this is it. Now all our troubles have evaporated. Now we can drill more wells and produce more crude and refine more oil and get higher prices because we won't ever have to worry any more about there being too much oil to meet the demand."

So they did just that. Or, rather, they did more than just that. They overdid it. And you know what happened. Domestic supply went up more than import supply went down and there was a bigger surplus than before and prices went down instead of up.

So for months the industry's psychology was glum, glummer, glummest. But just recently the price of gasoline has gone up a bit in some places so doubtless everybody will begin to glow all over.

This tendency of oil men to go overboard for either optimism or pessimism is illustrated by a conversation we recently overheard between top-drawer executives of two big oil companies. We'll call them Mr. Glum and Mr. Glow.

Mr. Glum was telling how his company is pulling back on its expansion plans, cutting costs in every possible way, and digging in for a long pull of hard times. He said there is too much drilling, too many producing wells, too much refining capacity, and too much of everything except demand, so that for a long time there is going to be bitter competition, depressed prices, and meager earnings.

Mr. Glow said, yeah, maybe so right now. Things may be pretty rough for a few months. But demand for petroleum products is going to keep on increasing steadily year after year, so why not prepare to get your share of it? This present oversupply is only temporary. It'll be brought under control some way. And just a little spurt in demand would wipe it out and then everything will look rosy again and the oil business will boom.

So there you have it. Maybe there are two sides to the outlook. Maybe there always have been. Maybe the way to cash in on mob psychology is to go the opposite way from the general herd.

Maybe things are never all good or all bad, but just look that way because of the oil industry's century-old habit of easy glum, easy glow.

—*Henry D. Ralph.*

Sparking sample for spectrographic determination of phosphorus.

Announcing new methods for rapid determination of phosphorus in gasoline

Ethyl Research develops spectrographic and colorimetric procedures

In recent years, phosphorus compounds have been used extensively as gasoline additives to combat surface ignition and spark plug fouling. Indications are that phosphorus deposit modifiers will be even more important in the future. This has created a need for rapid methods to determine phosphorus in gasoline.

Ethyl's Detroit Research Laboratories have developed two analytical procedures to satisfy this need. One of these is spectrographic and the other colorimetric.

Both procedures apply to a wide variety of phosphorus compounds. And they can be used effectively on gasolines containing additives such as tetraethyllead, antioxidants, dyes, and metal deactivators.

Spectrographic Method

Phosphorus concentrations* of 5 to 75 mg. per liter of gasoline can be determined by the spectrographic method with a standard deviation of 0.8 mg. per liter. A single phosphorus determination can be made in 30 minutes; a two-man team can make 70 such determinations per day.

The gasoline is analyzed without pretreatment except for adding a radiation buffer and an internal standard.

The buffer solution, consisting of 60 percent dimethylformamide and 40 percent isopropanol, improves the phosphorus line intensity and also reduces the effects of base stock and additives. Triphenylarsine, added to the buffer as

Phosphorus concentration is frequently stated as "theories of phosphorus". A theory is the weight ratio equivalent to two atoms of phosphorus to three atoms of lead.

the internal standard, further reduces the effects of variations in sample and additive composition.

An inert atmosphere of argon prevents sample ignition. The argon also enhances the intensity of the phosphorus line.

Analytical curves are plotted to give phosphorus concentrations in units of grams per liter, or as "theories of phosphorus" for a given tetraethyllead concentration.

One curve can be used for samples containing commonly used phosphorus additives. Separate curves are needed for samples containing more volatile phosphorus compounds such as trimethyl phosphate, triethyl phosphate, and dibutyl hydrogen phosphate.

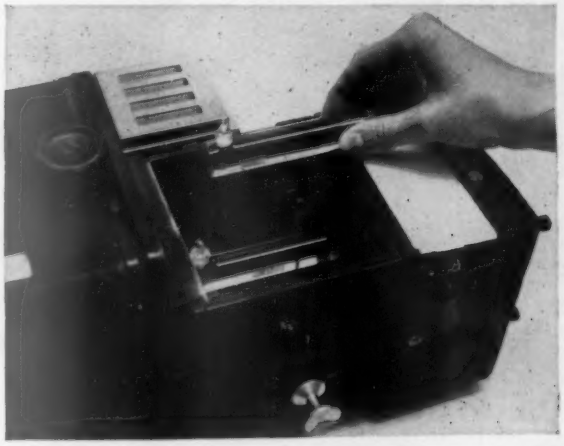
A correction is required for samples containing manganese.

Colorimetric Method

The colorimetric procedure is slower than the spectrographic method but more accurate. It can be applied to gasoline containing from 5 to 50 mg. of phosphorus per liter with a standard deviation of 0.5 mg. per liter. An hour is needed for a single determination; 24 can be made per man day.

The fuel sample is adsorbed on zinc oxide and ignited to oxidize the organic phosphorus. It is subsequently converted to the orthophosphate ion by dissolving in sulphuric acid. In this form phosphorus is readily measured in the presence of zinc, using a molybdenum blue method. Color obtained is stable and reproducible.

Ethyl's experience with a large number of gasolines containing a variety of antioxidants, dyes and metal deactivators has shown that these additives do not interfere with the determination; neither does manganese added to gasoline as (methylcyclopentadienyl)manganese tricarbonyl.



Inserting sample for colorimetric procedure.

Comparison of Spectrographic and Colorimetric Methods

	Spectrographic	Colorimetric
Sample size, ml.	4	1
Elapsed time for one determination; minutes	30	60
Determinations per man-day	35	24
Concentration range, mg./liter	5-75	5-50
Standard deviation, mg./liter	0.8	0.5
Base stock effect	none	none
Phosphorus additive effect	Additional calibration needed for volatile compounds	none
Manganese interference	Correction required	none

How Ethyl Research can help you

Copies of the paper, "Rapid Determination of Phosphorus in Gasoline," presented at the recent API Division of Refining meeting, are available through your Ethyl Representative. It is a detailed description of the analytical procedures outlined here.

The need for rapid methods to determine phosphorus in gasoline has arisen from the widespread acceptance of phosphorus additives as deposit modifiers. Ethyl has available three such additives. Two of these are free from any patent complications. Your Ethyl Representative will be glad to supply you with full details.

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Do you want to pay more for gasoline?

THE STATE OF WISCONSIN makes a remarkable statement in its brief filed with the Federal Power Commission in the Phillips gas case.

It complains that under the regulatory method proposed by the examiner in this case the price of gas is likely to go up while the price of oil could remain constant or even decrease. It says:

"The type of regulation applicable to natural gas is price regulation. The type of regulation applicable to oil is supply regulation. The objective of price regulation is to hold down prices to a reasonable level or to establish price ceilings. The objective of supply regulation is to hold prices up or to establish price floors.

"The objectives of the two forms of regulation currently applicable to gas and oil are diametrically opposed. Under these facts of regulation we can discover no basis whatsoever for escalating the price of gas, and holding the price of liquids constant.

"If the objectives of the two schemes of regulation were fully realized the escalation should be reversed, with the price of gas constant and liquids escalated."

THIS IS PRECISELY what producers have been saying all along. But they have never stated it so frankly and bluntly. And gas-consumer interests have generally denied or evaded the point.

What Wisconsin is saying is that it is national policy to hold down the price of gas but let oil prices rise as much as the market will bear.

This means that the two fuels are not to be competitive in the marketplace. It means that gas is not to bear its fair share of exploration and production expense. It means that as producers' costs rise due to inflation, deeper drilling, or any other cause, the full amount will be added to the price of oil and none to the price of gas.

In other words, oil prices are certain to go up as a direct result of the present method of regulating producers' gas prices.

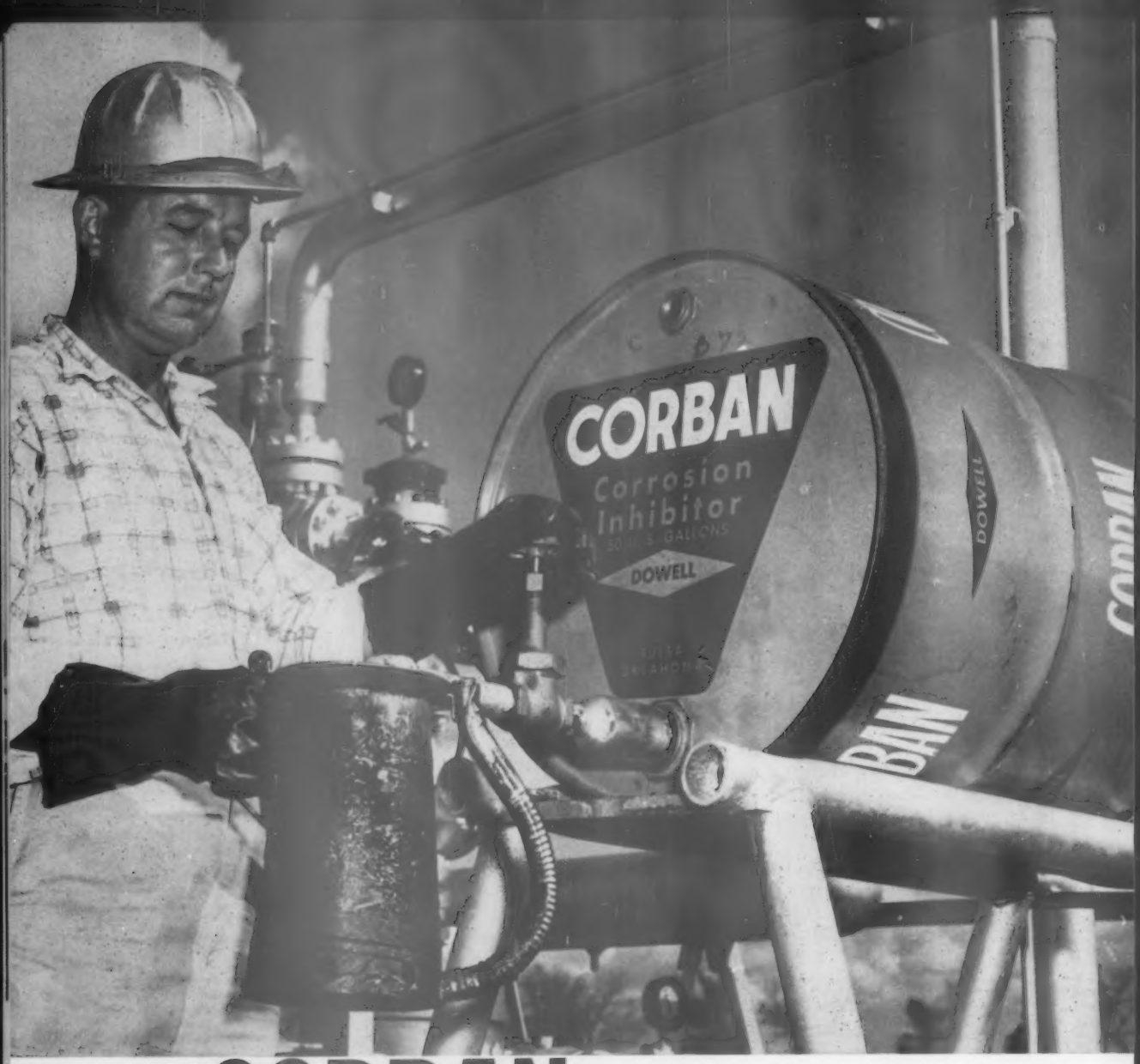
TELL THIS TO OIL CONSUMERS and see how they like the prospect of paying more for gasoline in order that somebody else can pay less for natural gas.

Is this a national policy that has universal endorsement? Was it deliberately and knowingly adopted by Congress? Is it sound and fair?

The Wisconsin statement of the situation is absolutely correct. But Congress and the public have never had it presented just like that.

If producers will now drive this fact home to all oil consumers, there could arise a ground swell of opposition to this system of gas regulation that the courts, not Congress, have imposed.

Sensible gas legislation will be enacted when the public becomes aware of this truth: The present method of gas regulation automatically guarantees higher prices for oil.



CORBAN

now available through 165 points in the oil country

Corban®, Dowell's family of polar-type corrosion inhibitors, is now available through 165 service points and offices in the oil and gas producing areas of the United States, Canada and Venezuela.

Now you can get effective corrosion protection for your oil and gas wells, without unnecessary freight costs and delays caused by shipping from distant points.

In addition to ready availability, Corban offers other important advantages. It is made in more than a dozen formulas, and comes in several forms: "ready-to-use" liquid, concentrated liquid and sticks—to meet *your* well problems.

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Products for the oil industry DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

How 25 Companies Fared During the First Half

	First-half net profits		Per share		Refinery runs (Thousand bbl. daily)		Production (Thousand bbl. daily)	
	1959	1958	1959	1958	1959	1958	1959	1958
Jersey Standard	$315,000,000	$249,000,000	1.47	1.22	2,783.0	2,364.0	2,515.0	2,339.0
Texaco	162,723,460	138,535,541	1.23	1.17	1,201.0	1,131.0	1,195.0	1,064.0
Gulf	141,814,000	115,737,000	4.38	3.57	680.6	685.7	1,422.9	1,326.0
California Standard	118,152,797	116,735,443	1.87	1.85	499.6	497.3	397.0	398.2
Creole	115,500,000	117,200,000	1.49	1.51	358.5	303.9	1,181.2	1,032.0
Indiana Standard	78,851,272	52,423,067	2.20	1.47	666.0	636.8	314.9	271.8
Socony Mobil	77,100,000	63,000,000	1.59	1.30	930.0	844.0	748.0	707.0
Shell	69,186,731	53,871,746	2.28	1.78	485.4	447.1	321.0	288.0
Phillips	53,208,794	36,411,576	1.55	1.06	224.6	212.0	224.0	200.1
Continental	29,160,000	20,653,000	1.38	1.03	173.3	157.3	154.4	126.8
Sinclair	27,031,877	22,355,811	1.76	1.45	430.7	415.6	184.9	186.4
Imperial	23,334,000	24,153,000	.74	.77	293.0	252.6	81.6	75.7
Sun	21,974,000	11,560,000	1.87	1.01	236.5	223.7	133.4	101.1
Sunray Mid-Continent	19,936,000	19,251,000	1.05	1.01	110.2	101.3	83.9	78.4
Cities Service	18,904,000	18,067,000	1.76	1.68	.....	.....	141.6	125.1
Ohio	18,556,445	15,086,974	1.41	1.15	44.7	39.6	110.9	95.3
Atlantic	16,400,000	7,667,000	1.74	.78	196.3	185.2	136.3	114.1
Skelly	14,522,508	10,548,955	2.52	1.83	47.9	48.9	66.6	61.4
Union Oil	10,771,823	11,456,744	1.32	1.40	.....	.....	.....	.....
Richfield	10,694,790	10,409,500	2.65	2.60	136.3	113.5	69.1	60.9
International Pet.	10,100,000	9,000,000	.69	.62	.....	.....	121.1	130.5
Union Oil of Louisiana	6,675,448	4,090,691	1.41	.86	.....	.....	18.0	11.9
Sinclair Venezuelan	6,182,499	8,645,749	1.54	2.16	13.8	9.5	45.0	54.1
Anderson-Prichard	3,044,098	1,377,089	1.71	.71	29.6	31.3	14.7	11.9
Delhi-Taylor	1,460,314	−714,812	.28	−.14	40.7	24.1	5.4	5.3

Oil Stages Great First Half in '59

- Executives predict spectacular profit trend will hold through rest of year if gasoline prices remain firm. They attribute prosperity in first half to sharp jump in demand and increased production.

OIL companies shared the fruits of the booming American economy during 1959's first half and rolled up some spectacular profits.

The midyear reports are just now being published, and they show a uniform picture of prosperity.

Several companies reported the best first-half profits in their history. Nearly all the domestic operators recorded sharp gains over 1958 performances.

Gains ranging from 15 to 60% were common. A few even more than doubled their earnings made in the same period last year.

A slightly different picture is developing, however, among the companies that concentrate operations in one country abroad. A few in this category showed a decline in earnings.

This was the case for Imperial Oil, the Canadian subsidiary of Standard Oil Co. (N. J.); Creole Petroleum, Jersey Standard's Venezuelan subsidiary; and Sinclair Venezuelan. In these instances, import restrictions and the new Venezuelan income tax played roles in shaving profits.

The national view . . . Several oil executives reported that petroleum demand in the first half exceeded forecasts.

This probably stems from the fact that the national economy zoomed out of the 1958 recession at a much faster clip even than most economists expected.

One gage of economic performance is Gross National Product, total output of goods and services produced in the nation. The Department of Commerce reports now that GNP reached an annual rate of $470.2 billion in the first quarter, probably was running at a rate of $482 billion in the second, and will reach a $500-billion rate in the fourth quarter.

The $500-billion pace formerly was a target set for the first half of 1960. Economists for the Federal Reserve Board now estimate that GNP will be affected only slightly by the current steel strike.

If the national economy should roll along at its present pace, oil men feel certain that petroleum demand will be firm in the second half and they'll wind up the year with profit increases.

The outlook . . . Many executives confidently predicted in midyear reports that good first-half business will

continue through the rest of the year.

The British American Oil Co. report noted: "The last half of each year usually experiences a seasonal increase in product demand over the first 6 months."

President W. C. Norman of Colorado Oil & Gas Corp., declared, "prospects for increased earnings for the last half of this year are considered quite favorable."

L. F. McCollum, president of Continental Oil Co., reported his company planned to step up its capital spending in view of the continued high level of business activity both for oil and the economy as a whole.

The year's capital expenditure budget for Continental has been increased by $15 million with greater spending for exploration and new pipeline projects accounting for the major portion of the increase, McCollum said.

He added: "It is anticipated that a record number of exploratory and development wells will be drilled during 1959."

Sinclair Chairman P. C. Spencer said that if the current firming trend in gasoline prices continues "it is reasonable to expect the remainder of 1959 should continue to show improvement over the results obtained in 1958."

Indiana Standard executives—Chairman Frank O. Prior and President John E. Swearingen—said that an adequate price level for products the rest of the year will depend on one thing: "The restraint and sound judgment of the nation's refiners in tempering their output to the demands of the market."

They noted that excessive industry inventories, especially of gasoline, caused product prices to weaken in the second quarter. A correction has set in so far in the current quarter.

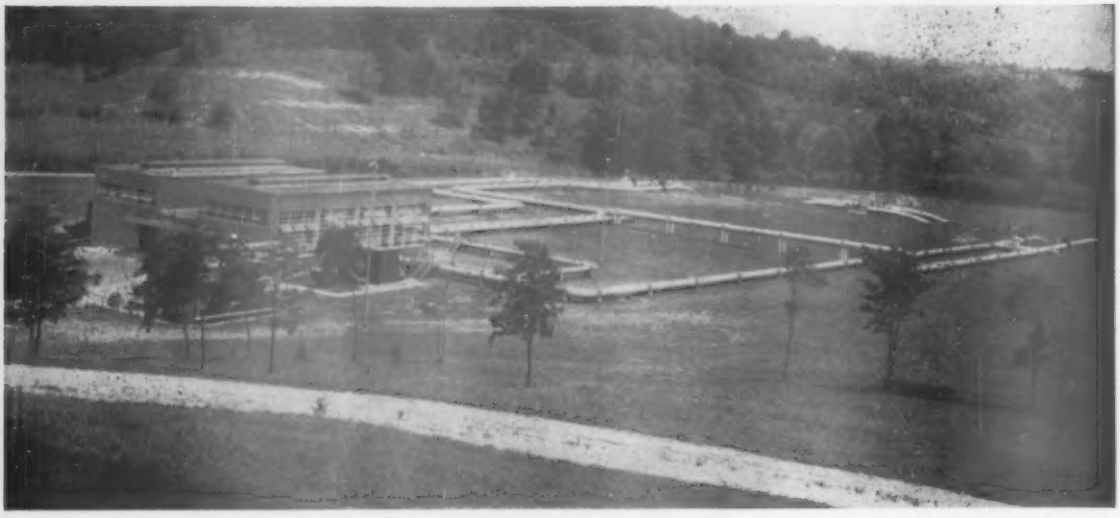
Both Prior and Swearingen pointed out that the second-half results to some extent will be influenced by the steel strike and walkouts at four of Indiana Standard's own refineries.

"Even allowing for these unsettling factors," they said, "the net effect for the year as a whole should be to achieve a sound recovery from the recession levels of last year."

Behind the gains . . . The explanations for the increased first-half earnings fit a pattern.

Factors involved are:

. . . Increased products sales. Several companies reported the greatest volume of sales for any first half in their corporate history. Jersey Standard and Indiana Standard both reported a 9% increase over the same period in 1958 and Continental a 7.6% increase.



A NEW CONCEPT in gas-line station design was used at Mount Pleasant, Tenn. The station was built with only one motor to handle the entire load.

Texas Eastern's Gamble Paying Off

• Company proves you can have both economy and reliability with a single big compressor unit without standby capacity.

THREE years ago 15,000-hp. electric-motor-driven gas compressors—by far the largest ever installed on a pipeline—were placed in service at three Texas Eastern Transmission Corp. stations.

Much of the gas-transmission industry raised its eyebrows at Texas Eastern's single-unit stations. This was indeed a revolutionary design concept.

For years compressor stations have been built with several small units for security if not for flexibility. Gambling the power of an entire station on the reliability of one unit to gain maximum economy was an unheard of risk. The loss of throughput at a peak-demand period could be very serious.

Now, with the perspective of 3 years, what has been the result of this bold design departure? During a second tour of one of these electric stations conducted for the trade press, Texas Eastern reported these benefits:

. . . The lowest initial cost in the industry, as a result of concentrating horsepower in large units. (The Mount Pleasant, Tenn., station, now with two 15,000-hp. units for added capacity, cost $3,518,000, or $117.27 per horsepower; this is roughly half the

Socony Mobil, Phillips, British American, Anderson-Prichard, Ohio, and Sunray Mid-Continent all noted a vastly improved sales picture as one reason for the profits increase.

Sunray, with 11% better sales in the first half over a year ago, reported May was its biggest gallonage month of record and June gasoline sales were 17.3% greater than last year in the same month.

Several companies that reported specifically on their refinery runs noted gains in throughput to meet increased demand. Some others declared they held down runs and took products from storage to meet greater sales.

... Increased crude production. Nearly all the companies recorded production gains. Those attributing a rise in earnings to greater crude output included Indiana Standard, Socony Mobil, Phillips, Continental, Sinclair, Ohio, Sunray, Colorado Oil & Gas, and British American.

Several mentioned that greater volumes of natural-gas production and sales also were behind the profits rise.

In striking a balance sheet for the industry, some executives noted that excellent domestic demand for petroleum products plus the new imports-control program offset a few adverse trends. These trends were weak prices for crude and products and strikes.

Ohio President J. C. Donnell II said prices on his company's crude production averaged 9 cents a barrel lower and prices of refined products remained near the low level of the 1958 recession period.

Indiana Standard reported that its profitability and cost-control program favorably influenced its first-half earnings this year.

"We were able to hold operating, selling, and administrative costs at about the same level as a year ago in spite of the greater volume of business," company officers said.

Out of red . . . The 1959 first half was a milestone for American Petrofina, the Belgian-owned newcomer to the ranks of American integrated companies.

Petrofina showed net earnings of $355,000 for the period, an improvement of $652,000 over the same period last year.

Net cash income was $3,841,000, an increase of $1,100,000. Gross sales were $38.3 million compared with $33.5 million. The company is pursuing an aggressive marketing campaign in 13 midcontinent and southwestern states where it now has more than 1,600 outlets.

---

cost of a gas-turbine centrifugal station and one-third the cost of a gas-engine reciprocating station.)

... Low operating costs.

... "Negligible" maintenance (normally a major item in gas transmission).

... Reliability which justified the design.

Fears of shutdowns which would take a large amount of horsepower out of service have been groundless. The Mount Pleasant station which was visited last week has been on the line 99.3% of its potential hours. This compares with Texas Eastern estimates of 96% for a gas-turbine centrifugal unit and 90 to 95% for an individual gas-engine reciprocating compressor of the type installed on most gas lines.

In summing up the performance of the station, a Texas Eastern engineer said:

"This is the way to pump gas when conditions of load permit and when power is available at a reasonable price."

Future application . . . These first stations were built under ideal conditions for this type of drive.

They are located on the Kosciusko, Miss.-Oakford, Pa., system which has two 30-in. lines pumping into underground storage. Large storage capacity permits high load-factor operation year round. Last week Mount Pleasant station was pumping near its design capacity of approximately 1 billion cubic feet of gas per day.

Power was available at an average rate of about 4½ mills per kwh. The advantages of large electric units in a cheap power area are obvious. But the success of these stations implies that their application will not be limited to the Tennessee Valley or other extremely low power-rate areas.

Other station advantages . . . The Mount Pleasant station and similar ones were designed for possible future remote operation, as have all Texas Eastern's electric and gas-turbine stations built since 1952.

Being of local push-button design, the stations will require only the installation of supervisory equipment to convert to remote control.

There are eight men under the present mode of operation—one chief operator, four operators (one per 8-hour shift), one relief operator, one mechanic's helper, and one maintenance man.

Impeller sizes for the compressor may range from 30 in. to 37 in., making the station readily expandable. When demand requires a 37-in. impeller can be installed to boost horsepower to 20,000 in each unit. With this impeller the single-stage compressor can develop the extremely high compression ratio of 1.56:1.

The use of simple rotating equipment permitted substitution of a single-line strainer for conventional gas scrubbers. Centrifugal equipment is not so vulnerable to damage from foreign matter in the line as is reciprocating equipment.

The use of "across-the-line" rather than reduced-voltage starting resulted in a $150,000 saving in initial cost. Elimination of a basement due to the simple design enabled further saving.

Land Limit Doubled

. . . in Alaska by Congress.

Bill now goes to president.

A BILL to increase the acreage limit on federal leases and options in Alaska was passed by both houses of Congress last week.

If signed by the president, the measure will permit the individual or company to hold mineral leases or options on up to 600,000 acres.

Besides raising the acreage limitation, it does away with the present distinction between leases and options in the new state. The old law set a limit of 100,000 acres on leases and 200,000 acres on options.

The measure ran into unexpected opposition in the Senate when Sen. Gordon Allott (R-Colo.) attempted to send it back to committee. His motion was defeated 55-32.

Ceiling of 600,000 acres . . . Allott said that the present 300,000-acre limit can be extended to 800,000 acres or more by placing the acreage under unitization agreements or development contracts.

He said that one company already held more than 800,000 acres.

As originally introduced by Rep. Ralph J. River (D-Alaska), the bill called for a ceiling of 1,000,000 acres. The figure was lowered to 600,000 to meet objections from the Department of Interior.

However, the bill as passed does not include Interior's proposal to restrict the acreage limit to 300,000 acres on each side of the Brooks Range in Northern Alaska.

THE OLD approach to unitization—personal calls on royalty owners by company men or brokers.

NEW APPROACH uses the same material, plus a couple of letters, and does the job better.

Unitizing by Mail Saves Time, Tempers

• Personal contact is now old hat in selling royalty owners on the virtues of unitization—except for clean-up work. Oil men find there's less haggling, less suspicion, better relations by mail. And it's faster and cheaper.

Merle F. Blakely
District Editor

LICK a postage stamp and close a $306,000,000 deal.

That's oversimplifying it. Yet, using the mails to get royalty owners to sign unitization agreements is emerging as a fine industrial art.

It pays practical dividends because it:

. . . **Cuts in half** the time needed for completing a unit agreement.

. . . **Saves many thousands** of dollars by substituting the postage stamp for company engineers and land men and special hired brokers.

. . . **Gives the royalty owner** a better picture of his prospects under unitization than he often got in a personal visit.

Because 100 units are being placed in operation each year and because about 75% of all secondary-recovery and pressure-maintenance production comes from some 600 units now operating in the U. S., the system is growing in stature as a conservation instrument.

Why by mail? . . . The switch from personal-contact teams to mail has come during a period when personal selling—mostly by TV—has hit a new high, and it has bucked a rising tide of junk mail and too much paper generally.

But the letter has won out for several reasons:

. . . **Royalty ownerships** in most oil and gas fields are widely distributed, with owners living in many states and foreign countries.

. . . **A letter** hits all targets quickly. It took personal-contact teams far longer to cover their entire list. And they often had to wait longer to see one important royalty owner than it now takes letters to reach nearly the entire list.

. . . **Explicit provisions** of a unit proposal can be detailed easily in writing. And, every royalty owner gets the same story. There's no need for him to check his neighbor to find out what he might have been told by a company representative.

Not all companies are sold on the mail campaign. One major usually sends one letter to royalty owners. If the response isn't large and immediate, it puts its teams of contact men into the field to put the unit together.

Current example . . . How well the mail approach works is being demonstrated currently by Cities Service Oil Co., operator of a proposed secondary-recovery program in Northeast Purdy field in Garvin County, Oklahoma.

Cities Service terms it the biggest unit in the Mid-Continent because it involves 1,500 royalty-interest owners and 264 working-interest operators. It also promises to recover an 85,000,000-bbl. crop of extra oil—about six times the remaining primary oil.

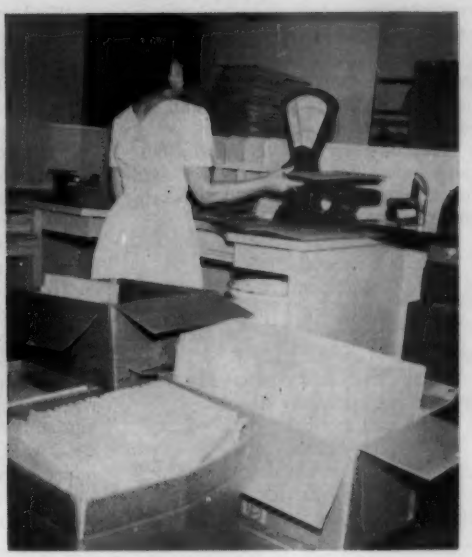
Cities Service values this oil at $3.05 a barrel, putting the value at about $259,000,000. With $47,000,000 worth of primary oil still in the ground, value of the total project reaches $306,000,000. Cost of the secondary-recovery plan is estimated at $19,200,000.

Cities Service sent out its first letter June 5. It followed up with a second letter July 16. Last week 56% of the 1,500 royalty owners had already signed the agreement, and returns were still flowing in.

Under the old personal-contact plan, Cities Service figures it would have spent $25,000 to $30,000 to sign 75% of the Northeast Purdy royalty owners.

By mail, it estimates the cost be-

NO SHORT CUT has been developed yet for operators' committees, which still must do the engineering and planning, but . . .



BROCHURES they prepare now go to the company mail room for quick distribution.

and Money

tween $1,200 and $1,800. In the current project, however, speed is important and Cities Service expects to wind up with a 3-week personal-contact push using perhaps eight men. This will run the total bill to between $4,000 and $5,000.

Different picture . . . There have been changes in recent years which make the mail-order units easier.

Oil men have found, for example, that royalty owners are much better informed than they used to be. Pressure maintenance and water flooding are familiar to most, and there's less suspicion today on the part of the ranchers, dentists, teachers, entertainers, and other royalty owners.

The companies, too, have changed. They're more frank and open in telling their story. They're now inclined to pinpoint the anticipated cash returns and to explain their proposal in detail.

"It used to be," says one land man, "that some oil men would hold back, not tell the whole story. This made the royalty owner feel that the company was not proud of the proposed agreement or had something to hide."

The mail campaign, he says, tells a more complete story and goes a long way toward improving and cementing good relations.

Some advantages . . . Savings in time and money are the big factors in the trend toward unitization by mail.

Before, companies paid brokers $25 a day plus expenses ranging from $12 to $21 to call on royalty owners and sell them on unitization. This was in addition to the expense of company personnel assigned to the job.

One company's experience showed that it took an average of two personal calls on each royalty owner. On the first call, the representative left informative material and explained the proposal. On the next he got the signature on the agreement.

Assuming 10 calls a day, which land men say is good, cost of contacting 1,500 royalty owners would exceed $11,000. Since then, though, the daily cost of a contact man has increased to between $35 and $40.

Besides cost, the mail system has another virtue. It jumps a psychological stumbling block which often delayed contact men.

The fact that an oil company sent a representative to pay a personal call seemed to magnify the importance of the visit and aroused the royalty owner's suspicion. He often wanted to put off signing while he checked other royalty owners to get their reactions and see if the same deal were being offered to all.

Mail contact also seems to erase the problem of different sales approaches by operators' representatives. With it explained on paper, everybody gets precisely the same story. There are no misunderstandings which in the past often strained relations and were reflected in later dealings.

The general approach . . . Trifles can be important in handling unitization by mail.

Companies are finding that appearance of their brochures, wording of their letters, and timing of the mailed pieces can be almost as important as the merits of the project.

Some put particular emphasis on such minor details as:

. . . Triple spacing of detailed information for easy reading.

. . . Underlining and capitalizing phrases dealing with costs, income, or obligations.

. . . Eliminating technical and legal terms to increase understanding.

. . . Emphasizing "you" and "your interest" and "our mutual benefit" to make the royalty owner feel a part of the plan.

. . . Avoiding promises. Companies tend now to present additional recovery and increased revenue as "our engineers' estimates" or "the opinion of our engineering committee."

In all cases, royalty or interest holders are urged to write or ask questions to clarify any point.

Personal contact isn't eliminated. Companies generally feel it is the best method of dealing with Indian agencies, organized groups of royalty owners, or state, federal, or local governments.

It's also used in clean-up work after letters have produced the bulk of expected signatures.

Cities Service's plan . . . To start the ball rolling on the Northeast Purdy project, Cities Service advised royalty owners by letter that secondary recovery was being considered.

It pointed out that wells were approaching their economic limit and secondary recovery was essential to

avoid plugging and abandoning some of them.

It then issued a press release to local papers announcing that royalty owners were being contacted and outlining the recovery plan.

The company then prepared a nine-page report for royalty owners, written in simple language and answering these questions:

What is secondary recovery?

Why is it necessary?

What is unitization?

What tracts are being considered?

How is the participation factor determined?

What effect will this have on other formations under my lease?

What will I gain?

What is my share in the proposed unit and how was it determined?

What is the plan for secondary recovery?

What are the lessees doing to assure the success of the project?

How can I estimate my income?

Each question was answered simply and concisely. The report closed with a formula which would permit each owner to calculate his royalty income.

Since there are three separate units within the Northeast Purdy project, Cities Service enclosed a ratification sheet for each unit for the royalty owner to sign.

To keep from confusing the royalty owner—and to facilitate handling later—one was in black type, one in brown, and one in green.

An accompanying letter asked the royalty holder to review the plan and sign and return the ratification. Within 4 weeks, 600 of the 1,500 owners had returned their signed agreements.

A follow-up letter went to owners who had not replied. It was a three-paragraph note urging "early attention" and expressing the hope the project would soon be in operation. By last week, signatures were well past 800 and still coming in.

Big opportunity . . . Of the 600 units now operating in the U. S., about 200 have been formed in the last 2 years.

Seven states have compulsory unitization laws. They are Michigan, Arkansas, Oklahoma, Washington, Oregon, Alaska and Nevada.

Louisiana, Florida and Alabama have unit provisions in statutes limited to cycling and re-cycling projects. Most units operating today were established on a voluntary basis.

Lessons are learned in every unit campaign.

One major operator, a staunch advocate of mail techniques, has this word of caution: "Keep away from

Phillips Blasts Zwerdling Decision

- A 140-page brief is critical of FPC examiner and terms his cost method unworkable. Phillips is appealing the ruling to the full commission.

"CONTRARY to the evidence, to reason, and to the law" is the way Phillips Petroleum Co. describes the decision of Examiner Joseph Zwerdling in the historic case under which the Federal Power Commission is attempting to regulate Phillips' gas prices.

Not only is the decision unjust to Phillips but it fails to disclose a practical method of regulating the gas prices of independent producers generally, the company says.

In an appeal to the full commission, Phillips lists 134 specific exceptions to findings and proposals of the examiner and backs them up with 140 pages of argument.

Phillips' document lists just about all the criticisms of the examiner's method that have been raised by other producers (OGJ July 27, p. 156), suggesting that Phillips can't live under it any better than other producers.

No surrender . . . Possibly because of industry criticism that it "surrendered" by making a cost presentation, Phillips insists that it never concurred that the cost basis is the proper method of determining gas prices.

Phillips says it had to go along because FPC would listen to no other. Also, if cost is to be the basis, then the company must make sure that its prices are not set below its costs.

Phillips took no position as to workability of cost-of-service method for the industry generally, the brief declares.

Phillips' brief criticizes the examiner for claiming, on the basis of this one hearing, that he has demonstrated that the cost method is applicable to the whole producing industry.

By then picking dozens of specific flaws in the method as applied to its own operations, Phillips strongly implies that the method is unsuitable for any producer.

Of greatest general interest is Phillips' reemphasis of the big volume of testimony it introduced showing the increasing demand for gas during the next few years, the difficulties of finding big new reserves, rising costs of deep drilling, and the need of the industry for financial incentives to do the required exploration work.

Evidence ignored . . . The examiner, in Phillips' words, "brushed aside all of this evidence with several completely fallacious arguments."

Among other things, Phillips says, the examiner allowed only 9¼% rate of return, denied tax benefits for depletion and intangible drilling expenses, and allocated to gas only about one-third of Phillips' total exploration expense.

During the hearings, spokesmen for gas distributors had more or less taken the attitude that evidence as to the future was academic and that a producer's prices should be fixed on the basis of his past experience.

Phillips' great stress on the industry's trends of supply and demand indicates that FPC will be pressed to take a much broader view of the problem of producer regulation than is presented by any one producer's account books.

The examiner "makes himself his own expert," Phillips says, and misuses basic data on such subjects as drilling depths, exploratory wells, discovery evaluations, reserves growth, and exploration costs.

"Due to the increasing cost of finding new gas reserves to replace those reserves which are being produced," the brief says, "Phillips and other producers are faced with the necessity of plowing back into the business constantly increasing sums of money, simply to maintain, let alone increase, the rates of delivery; or, in other words, to maintain service to the consuming public.

"Normal financial depletion and depreciation accruals based upon the investment in the old reserves which are being produced are not enough to replace those reserves.

"In this respect the producers have a situation unlike that of pipelines

royalty owners—your own inconsistencies of conversation may trip you."

Another major company, with several big units under way, says that "always, a few owners when contacted in person were cantankerous without cause. They took your time, not on merits of the unit, but in citing a busted fence not repaired or perhaps loss of a calf attributed to pollution or some incident remotely related to oil."

While there is merit in airing "beefs," in many cases they were entirely foreign to the project. The written note soars over these rough spots.

In every program, there are bound to be a few knotty problems which must be unraveled in person. However, the well-organized mail crusades today appear to have arrived as effective tub-thumpers for the complicated oil industry story.

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and utilities which must be provided for in some manner.

"So long as the commission adheres to net investment as the rate base (as distinguished from value as the rate base), this peculiar situation cannot be provided for in the rate base. It can only be provided for out of income.

"The provision of these funds to meet the increased cost of replacement of reserves is necessary in order to provide Phillips and other producers with an incentive for further exploration and development. Consideration of this plow-back problem is therefore all-important in connection with the tax treatment and rate of return."

Problem unsolved . . . The core of the problem of finding a producer's past costs of gas is allocating his total costs between pipeline-quality gas and the liquid products of the wells, both as to exploration and operating expenses.

The examiner completely failed to solve this basic problem, Phillips says.

The examiner used accounting methods based on the relative market value or sales realization of the products, which Phillips says give no real allocation of costs at all but merely divide gross profits among joint products by shifting costs from one product to another.

Among the many specific and technical objections to this method, Phillips says that the examiner virtually admits that oil will have to bear an excessive share of the total cost of finding and producing oil and gas as a joint operation.

watching WASHINGTON

Joe Reilly

• Oil marketing may face another probe . . .

TWO YEARS AGO Rep. James Roosevelt (D-Calif.) was interrupted in the midst of a much-publicized investigation of the oil industry.

As chairman of a House small-business subcommittee, he had conducted public hearings in Denver, Los Angeles, and Chicago. The group had announced plans for further hearings in St. Louis, Cleveland, and Houston.

In the first three cities on the itinerary, members of the subcommittee had probed diligently—and sometimes successfully—for alleged abuses in marketing practices of the oil industry. They had received generous recognition in newspaper headlines, including those where Roosevelt wanted them most—in the Los Angeles district which sent him to Congress.

Suddenly, the investigation was halted. Members of the subcommittee returned to Washington, reportedly at the urging of House leaders. It seems that the leadership took a dim view of headline-producing investigations in various home districts at the time other congressmen were trying to wrap up their legislative bundle in Washington.

NOW ROOSEVELT IS THINKING of resuming the probe. He is carefully analyzing replies to questionnaires which he mailed out several weeks ago to petroleum suppliers and representatives of retailers, wholesalers, and jobbers.

The questionnaires were intended not only to "determine existing distribution practices affecting small business concerns within the industry" but also to detect changes that may have occurred since the 1957 hearings.

Roosevelt has refused to disclose the nature of replies he has received. In some cases, the replies didn't say all he wanted them to, so he's seeking more information.

If the replies and the prospective investigation prove fruitful enough, Roosevelt is likely to introduce another bill to divorce the marketing branch of the oil industry from the refining branch. He had such a proposal in Congress in 1957. The untimely suspension of his investigation deprived him of the chance to show the need for such legislation.

Since then, Roosevelt has had a rather dull legislative role. As a crusading congressman, he fought valiantly this session to abolish the House Committee on Un-American Activities, which had been given the job of investigating Communist influence in this country. His efforts brought a few headlines; but some of them were not very flattering even though he made it clear that he wanted the anti-Communist drive to be continued by another committee.

ROOSEVELT ALSO HAS MADE his influence felt on other congressional issues. He tried, for instance, to boost federal appropriations, reduce taxes, and prevent an increase in the national debt. His stand was popular, but it brought him little acclaim. He had to share the credit with too many of his colleagues who held the same views.

An investigation of the oil industry, as others in Congress have found, is almost sure to be popular. Roosevelt has refused to say, though, whether he intends to resume the oil study.

An announcement is expected about the time Congress adjourns. It may be held up a little longer if dissension develops within the subcommittee. Besides Roosevelt, the group includes Tom Steed (D-Okla.); Charles H. Brown (D-Mo.); Arch A. Moore, Jr. (R-W. Va.); and William H. Avery (R-Kans.).

Oil observers in Washington are speculating that Roosevelt will decide, after careful consideration, to resume the interrupted investigation. And they have a hunch that one of the hearings may be held within the circulation range of Los Angeles newspapers.

PHOTOS IN THE **NEWS**

Latest Hot Suit Made From Aluminum Fabric

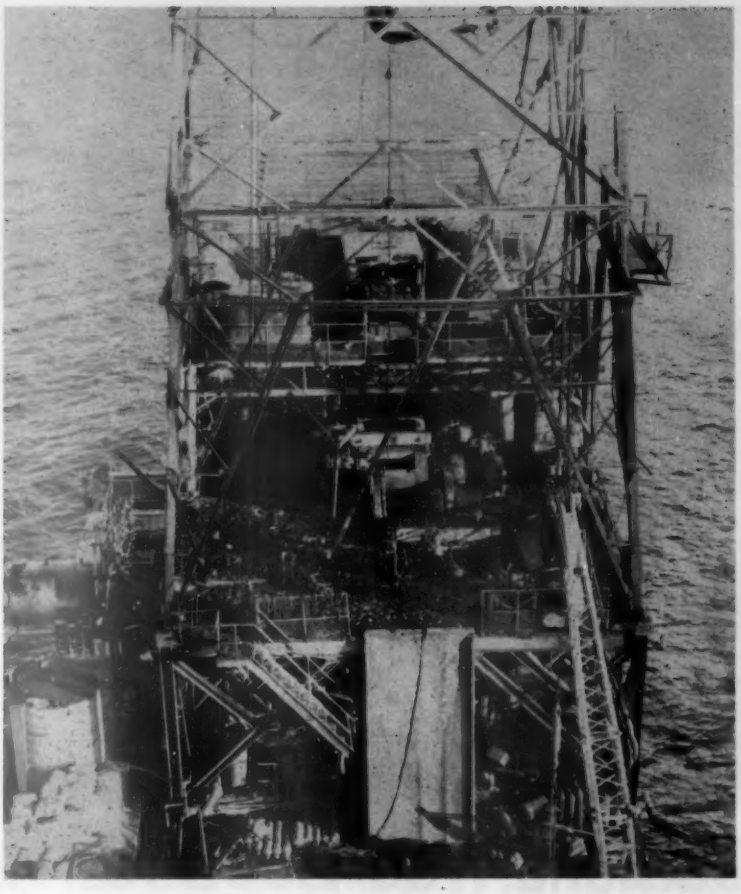
A maintenance man at Esso's Bayway refinery is a weird-looking sight as he climbs onto an operating unit dressed in a new-type heat-resistant suit.

His head-to-toe proximity suit is made of Scotch-Shield aluminized fabric. It reflects 90% of all radiant heat—much more than the conventional, heavier asbestos garments.

The reflective clothing is made by a process known as vacuum-treating aluminizing. In it, small particles of aluminum are drawn onto the surface and between woven threads of the fabric. The finished surface does not peel when subjected to heat as does foil-coated fabric. Process is patented by Minnesota Mining & Manufacturing Co.

Whiting Pickets Aim Cross-State Blow at Wood River

Pickets march with placards outside the Indiana Standard refinery at Whiting, Ind., where 5,000 members of Independent Petroleum Workers Union are on strike. Whiting pickets later motored across Illinois to company's Wood River refinery, which then was shut down when Central States Petroleum Union workers honored the picket line. Company and union resumed talks late last week at Whiting but not with OCAW locals on strike at three other Indiana-system plants. Supervisory personnel are partially operating four of the five struck plants.



Signs of Big Blowout

The debris-strewn deck of a Gulf of Mexico rig gives photographic evidence of the blowout and fire that forced a crew of 12 to jump to safety in the water 40 ft. below.

The rig, owned by Salt Dome Drilling Co., was drilling for Gulf Oil Corp. in Block 134, South Timbalier area off Louisiana, when the bit struck a gas pocket at 4,880 ft. The blowout preventers were closed, but the flow was diverted to the choke manifold and back into the mud pit. The gas caught fire and burned 4 hours into the morning of July 27.

One man drowned and eight of the 11 survivors were hospitalized.

The drilling rig is being replaced because of damages, but the platform did not suffer greatly. Two minor beams were warped.

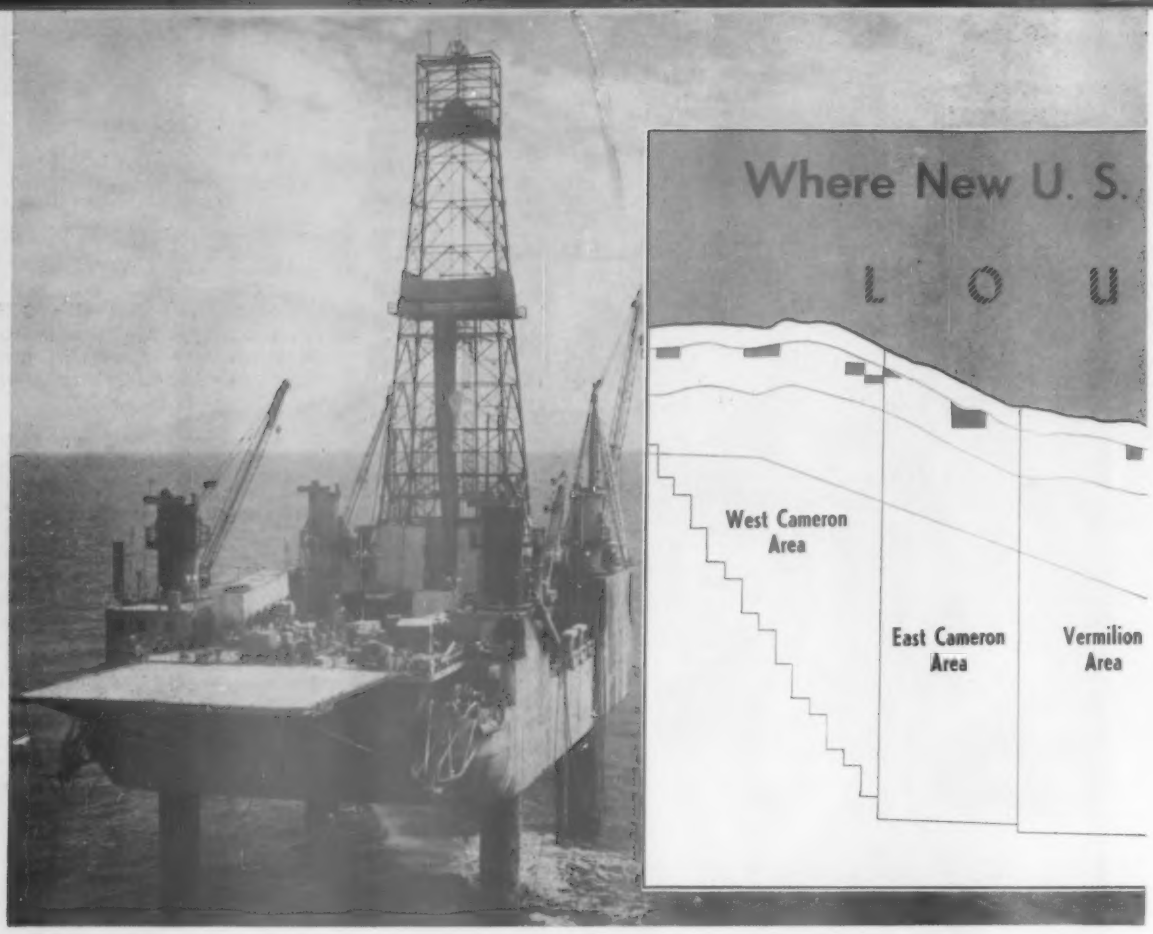
Buoy Is Revolutionary Oil-Loading Terminal

The Imodco Buoy is more than a navigational marker—it is the Swedish answer to an oil loading and discharging terminal capable of handling tank ships of any size.

Its big advantages: Low original cost and ability to operate efficiently in areas where other terminals aren't practical.

Developed by a Swedish firm, AB International Marine & Oil Development Corp., which also includes American engineers and businessmen, the buoy is anchored to the ocean floor. Submarine pipelines pass through it to carry the oil ashore, thus eliminating need for docks or harbor facilities.

Vessels moored to the circular structure can swing 380 degrees around it, always heading into the wind to permit unloading even in winds up to hurricane force.



Offshore Louisiana: Too Good to Pass

- Operators complain of many things, and profits are hard to come by. But this week's lease sale will prove what one oil man says about drilling in the gulf: "The industry will not let it die."

Howard Wilson
Gulf Coast District Editor

DRILLING in offshore Louisiana is on the rise—and with a federal lease sale set for this week and a state sale set for next month, it should get better.

But the producers and drilling contractors in what is still one of the really great frontiers of oil exploration aren't happy.

Their complaints are many, and most of them are justified. Costs are too high, allowables are too low, and the uncertainty of ownership of the tidelands has stunted development.

Murderous competition has driven down the rates of the drilling contractor.

Producers pay high bonuses for leases, spend big money to develop them, and then can't produce enough to make them pay out.

But even with all these troubles, the oil man still has confidence in offshore Louisiana. One driller said last week:

"Louisiana offshore still looks like, all considered, the best place on the Continent to find substantial reserves in a stable political atmosphere. The industry will not let it die."

What's happened . . . The number of drilling rigs in the Gulf of Mexico off Louisiana has risen from 38 at the start of the year to 59 today—a gain of better than 50%.

Virtually all this increase occurred during the past 4 months.

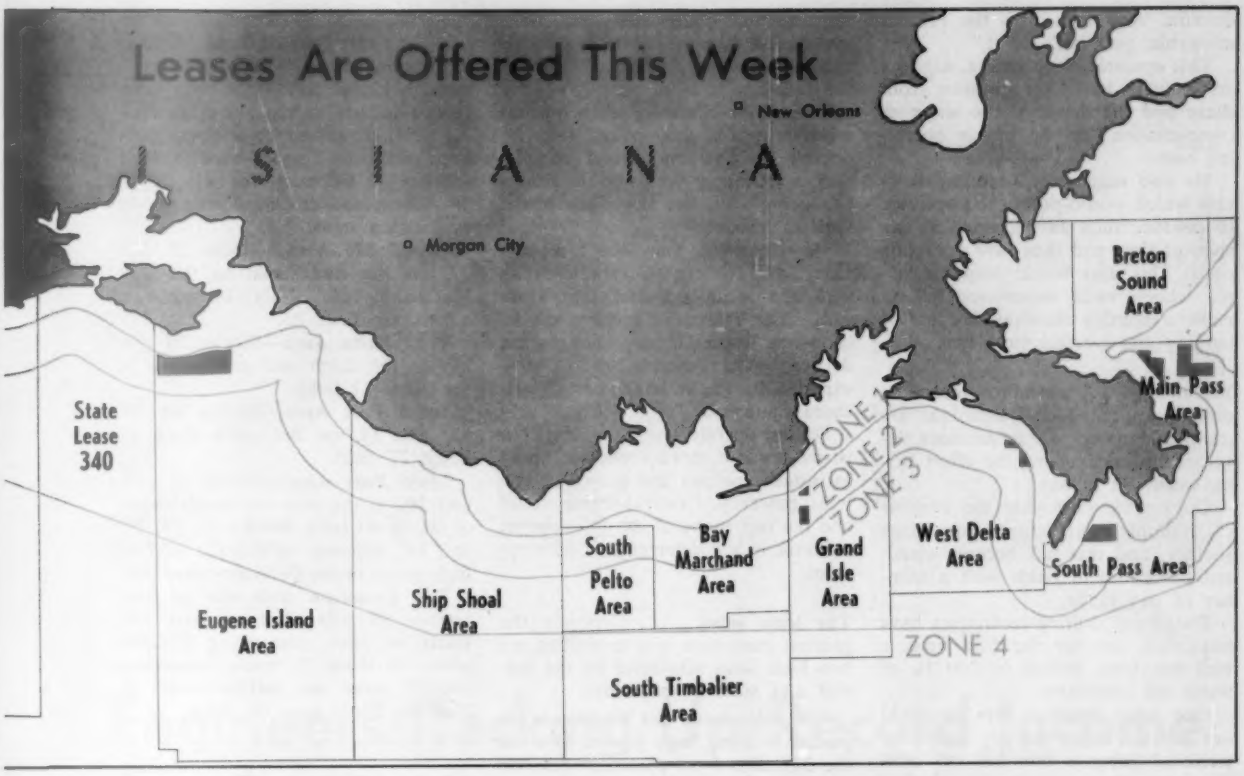
The Journal asked a dozen producers and drilling contractors why this increase occurred. Their replies fell in three categories: (1) The February lease sale by the State of Louisiana provided new drilling areas, (2) many older leases expire in 1960 and must be drilled, and (3) new pipeline outlets are giving incentive to new drilling.

The February sale added 36 tracts to the number under lease. Many had good potential production, and several already have proved up. Drilling is required within 1 year to escape heavy rental payments or loss of the leases.

Another 39 leases will be offered for sale by the federal Government Tuesday, while the state will put at least 24 more on the market September 17.

The economics . . . While today's drilling picture is better than it was 6 months and a year ago, it is still far off the 1957 levels. Nearly twice as many rigs—109 against 59—were drilling at the close of July, 1957.

Oil men know the reasons, and they express them freely.



Up Even at Today's Prices

"Everyone knows that offshore Louisiana is an oil province that hasn't reached maturity," explains one large operator. "But we have to ask the question: Does demand right now justify the expenditure when you are trading on the long-term demand for oil?

"Some of us are fortunate enough to have established production that will make us some money. Right now we are trying to maintain a balance between income and expenditures, and it is fairly close."

This same oil man then raises the basic question: Has offshore Louisiana, even with all its reserve wealth, been worthwhile?

"Turn the clocks back 10 years," he suggests. "Say we know we will invest $200 million and won't realize any return for 10 years. I question whether a lot of companies would have done it, even knowing what we know today about reserves."

This is hard talk, coming from an operator who has "succeeded."

Another big company has quit drilling its offshore leases entirely and farmed them out to others.

"There are a lot of oil prospects," says this operator, "but its hard to drill them and pay them out. We don't believe we will be active for some time."

Other producers, while complaining about allowables and pay out, concede they are making money. One major said the thick sands are responsible for their optimism—but this same major adds that the number of lease sales should be held up under present economic conditions.

Another operator says revenue will pay for "reasonable development," but, again, this operator actually has one less rig drilling today than he had a year ago.

Drilling contractors . . . The loudest moans come from the drilling contractor, who has to fight for jobs or let his equipment lie idle.

The Journal asked a number of contractors this question: Do you consider your current receipts to be adequate for a fair return on your investment?

"No!" fairly shouts one. "They should be at least 15% more. In fact, little or no real profits are earned at present rates."

Says another: "It costs a great deal of money to put together an efficient drilling barge equipped with present necessary drilling equipment. The present day-rate is too low, being far less than the rate in force approximately 4 years ago. A better allowable would stimulate day-rate prices."

Another sees a faint glimmer of hope: "The drilling rates are lower than they were 2 to 2½ years ago, and when related to capital invested, they are not high enough. They have improved some lately. But our costs are all up, and our rates don't always compensate."

The story is echoed by others.

The allowable . . . The one universal complaint of offshore operators is that allowables are too low.

They object to Louisiana's formula specifically, not simply the failure of demand to keep pace with new production. While Louisiana grants a favorable differential to offshore wells, it is not enough.

Where costs are sometimes triple those for drilling on land, the allowable differential of considerably less than 100% doesn't fill the bill.

"You can't justify an increase in drilling on the basis of allowables," says one operator. "You justify drilling on the opportunity to increase pro-

duction. And based on the present allowable, you can't do it."

This operator, with others, suggests an increase based on distance from shore and the depth of the water as compensation for the higher operating costs.

He also suggests a 3-month allowable which would permit the operator to produce such an allowable in one span of time and thus save operating costs. This also would help producers whose wells sometimes fail to make a monthly allowable because of barging and weather problems.

Technology . . . Improvements in drilling equipment and technique are playing a major role in offshore development and making the effort better worth the money.

During the past year the number of multiple completions has risen sharply, and this has become standard procedure in fields with a number of pay sands.

Deepwater drilling techniques have improved, and for the first time, a well has been drilled in 200 ft. of water off Louisiana.

One large operator says he could not put his finger on any particular technical advance that has cut drilling costs—but nonetheless drilling costs have gone down. He attributes this simply .to increased efficiency that is the product of years of experience.

"Each year we show some improvement," he says. "It's hard to spotlight the reasons, but the curve on the days it takes to drill wells continues to go down.

"We learn to control our mud weights better, we have better rig hydraulics, we have a better bit for particular intervals, we know what we're doing and where we're going. It's not so much uncovering any new principles as applying the old ones better."

What's ahead . . . For the future, several operators believe drilling in the Gulf will be spurred by development of floating drilling rigs, although there is no immediate demand.

One such rig has operated off Louisiana in recent months.

For more than a year there has been a huge surplus of equipment in the area, and the incentive is slight to invest in expensive new drilling methods. Furthermore, some operators believe that until a greater percentage of Gulf drilling occurs in water depths of 70 ft. or more, the value of floating rigs is limited.

"Beyond 70 ft. they will save money," one operator says.

Surprisingly, not a single operator suggested that underwater completions are needed in the Gulf to make offshore operations more economic in the future.

One major operator, when queried specifically on this point, said he doesn't see how underwater completion, a technique yet to be used on a producing well, has any place in the Gulf of Mexico.

He conceded that his company, along with others, is experimenting with the technique. But there's no rush. The reason is simply that its economic value, if any, lies in the deeper waters beyond 200 ft. Most experiments so far have been in offshore California.

Several operators say offshore Louisiana needs a more economical way to install pipelines and gathering systems generally. Costly barging of oil and the fact many of the gas reserves are shut in are deterrents to development.

The lease sales . . . Certainly the greatest immediate spur to drilling are two lease sales scheduled by the federal and state governments.

The federal sale this Tuesday is expected to bring high prices. Most of the 39 tracts were placed in the sale because of potential drainage from nearby or adjacent producing fields.

All are in Zone 2 and either abut the 3-mile outward limit of Zone 1 or are very close to it. Because Zone 2 lies in territory whose ownership is disputed by the U. S. and Louisiana governments, the bonus money will be impounded until the U. S. Supreme Court settles the matter.

The tracts are scattered through eight offshore areas and range in size from one small parcel of 30 acres to one of 3,790 acres. The total is approximately 81,000 acres.

Here is a rundown of the tracts and nearby production (in all cases only a portion of the blocks listed are up for lease):

West Cameron Area—Block 20, on the north flank of Block 45 field; Blocks 25 and 26, on the north flank of Block 40 field; and Blocks 34 and 68, on the north and east flanks of Block 67 field.

East Cameron Area—Block 2, on the south flank of Block 33 field; and Blocks 16, 17, 23, and 24, on the south flank of Block 17 field. All of Block 24 is offered but in two parcels. A portion of Block 9 originally was included in the offering, but was withdrawn last week. The portion up for leasing was on the south end of Block 4 field. It was withdrawn in order to avert any conflict with a state lease issued in this area.

Vermilion Area—Block 27, on the south and east flank of Block 14 field.

Eugene Island Area — Blocks 5 through 12, all forming a contiguous group, but not adjacent to a producing field. However, the northern portions of Blocks 7 and 8 went to Shell Oil Co. in February for a total of $8 million and are considered prime exploration areas.

Grand Isle Area—Blocks 25 and 37, on the east flank on the Bay Marchand field. Only 30 acres is offered in Block 25.

West Delta Area—Blocks 24 and 26, on the north and east flanks of the Block 27 field.

South Pass Area—Blocks 27, 28, 37, and 38, on the south flank of Block 27 field.

Main Pass Area—Blocks 42, 57, and 58, on the west and south flanks of Block 40 field; Blocks 45, 54, 55, and 66, adjacent to acreage sold at high prices in the February lease sale.

The Louisiana state sale of September 17 will offer at least 196 tracts of land, comprising 212,500 acres. Of these, 24 tracts comprising 66,000 acres are offshore—all in Zone 1. There may be more.

New Gas Is Tapped

. . . in British Columbia's north area by Westcoast Transmission 30-in. line.

A 250-MILE 30-in. gas line will be built by Westcoast Transmission Co., Ltd., to connect big new northern British Columbia discoveries to its system.

Westcoast has announced it is engineering the extension from Taylor, B. C., to Fort Nelson, B. C. The line will serve an area with newly found reserves estimated at more than 3 trillion cubic feet.

The strikes which will make available important supplies to Westcoast have stimulated another major play in the province (OGJ, June 22, p. 158, May 4, p. 154, and July 13, p. 189).

Westcoast reports that the Petitot River and Kotcho Lake discoveries made by El Paso Natural Gas Co.'s Gulf States Oil Co., may become the largest producing gas wells in Canada. Other promising fields are Clarke Lake, Klua Creek, Fort Nelson, Beaver River, and Bougie Lake, in the Fort Nelson region.

These and other discoveries during the past year have increased British Columbia gas reserves 4 to 5 trillion cubic feet, Westcoast estimates.

How Much Engineers Are Making

Year of Entry	Median Income in 1958					
	Civil	Electrical	Mechanical	Chemical	Mining and Metallurgical	Other
1958	$ 5,750	(*)	(*)		(*)	(*)
1957	6,040	$ 6,790	$ 6,500	$ 6,500	$6,000	
1956	6,520	6,880	6,700		6,500	$ 6,370
1955	6,680	7,360	7,500			
1954	6,930	8,000	7,420	7,500	7,250	7,580
1953	7,420	7,890	7,830			6,920
1951-52	8,090	8,660	8,590	8,400	9,130	8,700
1949-50	8,610	8,870	9,040	9,000	10,110	8,880
1947-48	9,360	9,780	9,760	9,900	9,750	9,920
1945-46	9,500	10,100	10,220	10,500		10,750
1943-44	10,190	10,680	10,850	11,330	10,800	11,000
1940-42	10,100	11,030	11,120	12,600	12,290	11,560
1935-39	11,130	11,150	11,970	13,850	11,400	12,830
1930-34	10,880	11,120	12,530	13,500	14,000	12,550
1925-29	11,450	12,270	12,530	13,500	12,600	12,610
1920-24	11,000	13,590	12,370	12,000	13,250	14,780
1915-19	10,820	12,500	12,670	(*)		12,130
1914 and before	10,360	14,000	12,500	(*)	14,000	16,000

*Fewer than 20 responses.

Engineers Racking Up Record Income

• Younger engineers are making biggest salary gains, NSPE survey shows. The smallest increases were reported by those who entered the profession during the 4-year period 1915-1919.

THE MEDIAN income for professional engineers has hit a record $10,000 annually—a 27% rise since 1952.

While incomes were at an all-time high in the recession year of 1958, the rate of increase during the last 2 years was less than previous 2-year periods. The 5% gain in median incomes from 1956 to 1958 compares with 12% from 1954 to 1956 and 8% from 1952 to 1954.

Making the greatest income gains in the last 2-year period were engineers with less than 10 years' experience. The greatest gain, $1,320, was reported by engineers whose experience dates back only to 1956. The smallest gain, $580, was by engineers who entered the profession in 1915-1919.

The income figures for 1958 were obtained in the National Society of Professional Engineers' fourth biennial survey. Approximately 19,000 engineers were polled by the NSPE. Participants in the survey represent about 41% of the society's membership. Earlier surveys, for 1952, 1954, and 1956, covered a similar percentage of a smaller membership total.

Chemical engineers tops . . . The recently completed survey, like the previous ones, shows chemical engineers to be the highest paid as a group.

The median income of chemical engineers in 1958 is listed at $11,170. This compares with $9,620 for civil engineers, the lowest paid; $10,270 for electrical engineers; $10,250 for mechanical engineers; $10,500 for mining and metallurgical engineers; and $11,080 for "other" engineers.

But the rate of gain for chemical engineers has dropped much more sharply than for the other groups. From 1956 to 1958 civil engineers gained 10% and electrical engineers 9%, while chemical engineers registered a gain of only 2%.

Self-employed engineers continued to fare better than their salaried counterparts. The median for self-employed engineers was $15,140 in 1958, compared with $9,700 for those working for others.

However, the rate of increase for the self-employed was down sharply, amounting to only 2% from 1956 to 1958 as compared with 11% for the preceding 2 years. By contrast, the median income of non-self-employed engineers rose 10% in 1956-1958 and 12% in 1954-56.

Thirty-seven per cent, or 6,457, of the engineers covered by the survey were in executive or administrative work. Most in demand for executive-administrative roles were engineers who entered the profession from 1915 to 1934. Of this group, half had executive or administrative jobs.

The survey indicates that 9% of the 1958 graduates already were in the executive - administrative field. About one-fourth of those with 10 years' experience held such jobs.

Design work followed executive-administrative as the second largest classification. It accounted for 28% of the engineers covered by the survey. This compares with 10% in construction supervision, 7% in research and development, 5% in sales, 4% in production, and 2% in teaching.

Of the newcomers to the profession, 42% were in design work. Construction supervision, production, and research-development each had 12%. Teaching is holding steady with about 2% of the newcomers.

Key Test Planned

. . . in Alaska's Koyukuk basin by group of 33 independents.

A SYNDICATE of Alaskan leaseholders headed by Paul Benedum of Pittsburgh plans to spud in the first wildcat in Alaska's interior some time early in October.

Location is 16 miles southwest of Nulato in the Kateel River district of Koyukuk Cretaceous basin of West Central Alaska.

It will be a 12,000-ft. test on a 99,840-acre unit held by the syndicate representing 33 different oil interests that control 4 million acres in the basin.

Raymond M. Thompson of Global Exploration Co., Denver, a consulting geologist and member of the syndicate's governing board, picked the well site.

Thompson said in Fairbanks the wildcat could have tremendous significance to the oil industry. "What Alaska needs is discovery of oil in another area other than the Kenai," he said.

The Benedum syndicate has purchased a drilling rig from Colorado Oil & Gas. The rig, capable of drilling to 15,000 ft., was one of three Colorado bought from the Navy in a $4-million deal.

It will be barged from Point Barrow up the Yukon River in early September. Mountain States Drilling Co. will supply labor for the drilling operation. The camp is now under construction with logistics being handled by Exploration Services of Fairbanks. Bill Packler, a veteran of the Navy's oil exploration in Petroleum Reserve No. 4, will be project manager.

Other members of the unit operating committee besides Benedum and Thompson are William S. Wallis of Marine Drilling Co., Ralph A. Johnson of Texas National Petroleum Co., T. E. Power of Mountain States Drilling Co., Robert O. Garrett of Texas Gas Exploration Corp., W. Y. Hollis of El Paso Natural Gas Products Co., and Michel T. Halbouty, Houston independent.

Transco Project Approved

TRANSCONTINENTAL Gas Pipe Line Corp. last week won court approval of its expansion plans and its new gas contracts.

Transco's plans already had been approved by the Federal Power Commission but had been appealed by United Gas Improvement Co., Philadelphia Electric Co., and the New York State Public Service Commission.

Issue in the appeal was the high gas prices allowed by the FPC in approving the project.

The U. S. Court of Appeals in Philadelphia last week in a split decision upheld the FPC approval. The FPC last fall had authorized Transco to proceed with a $167 million expansion program. It also approved Transco contracts with 26 gas producers which ranged from 22.4 to 23.3 cents per M.c.f.

The FPC approval had overruled an earlier examiner's decision which limited gas prices to 17 cents per M.c.f. initially.

Navajo Bids Soar

. . . on title-clouded leases as buyers, drillers gamble.

THE NAVAJO TRIBE received offers up to 77.1% of royalty on tracts of disputed land in the Greater Aneth field in a precedent-breaking lease sale at Window Rock, Ariz.

The Tribal Council broke from traditional policy and set a flat $500 per acre fee for bonuses. Bidding was based on percentage of production income to be returned to the tribe.

Bids were received with an understanding that the San Juan County, Utah, land is involved in a title dispute with the State of Utah. If the Navajo Tribe loses title, bidders will lose their $500 per acre bonus.

Despite this, bids were made on 16 of the 21 tracts. They ranged from 27.2% royalty up to the 77.1% offer, made on a 160-acre lease by Stephen C. Helbing and Frank J. Podpechan, Roswell, N. M., oil consultants. The two tied with Texaco on another 160-acre tract with an offer of 67.5%.

Bonuses risked . . . Utah already has issued leases on the area to Fehr & Lyons, a Salt Lake City firm. Utah claims the land under riparian rights, in which a state gets title to land adjacent to navigable streams and lakes within its boundaries.

The tracts lie along the winding San Juan river which in recent years has been navigated only by adventure seekers on rubber rafts.

Podpechan said that despite the legal threat, he and Helbing will begin drilling as soon as final papers are signed.

INDUSTRY BRIEFS . . .

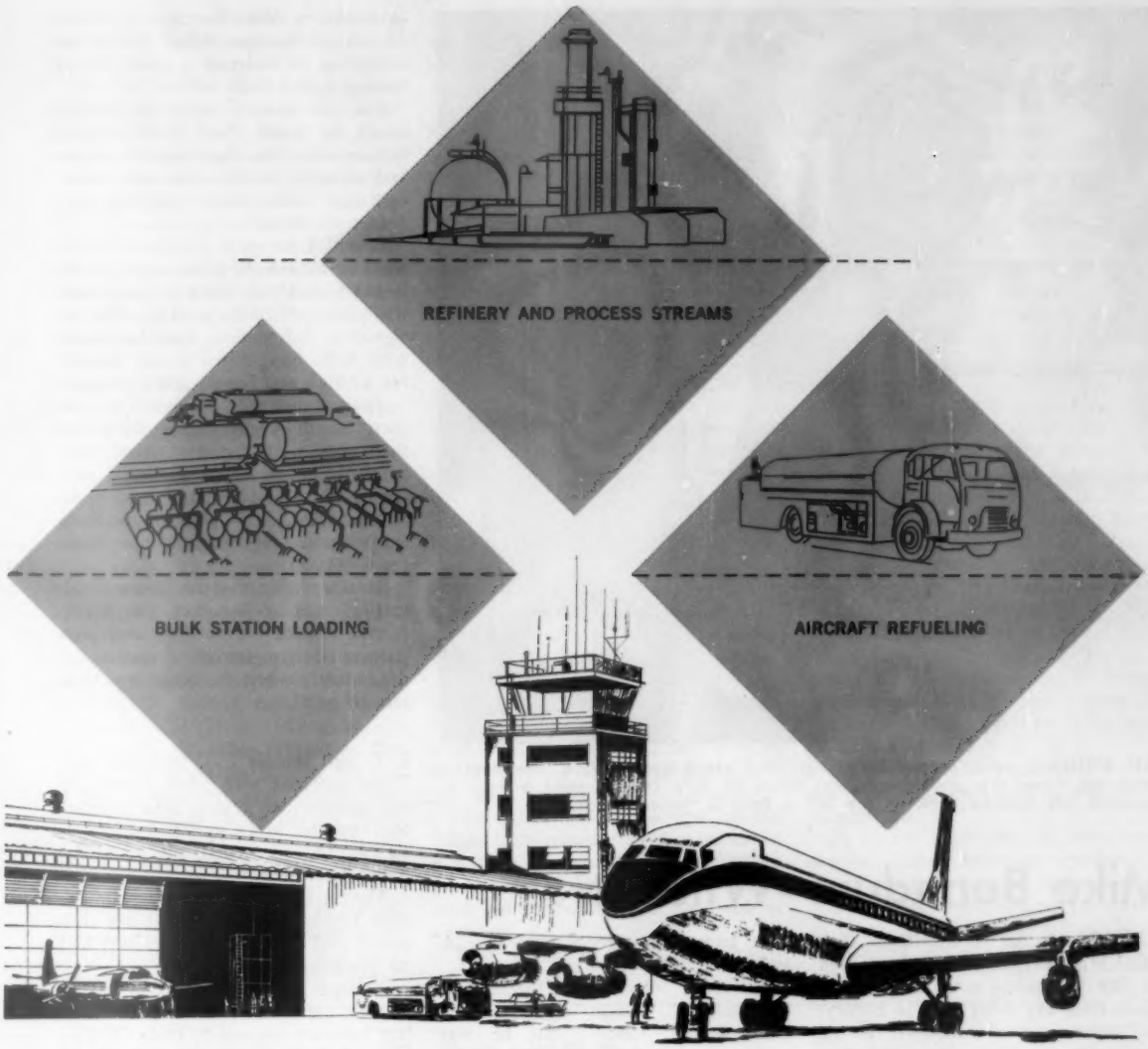
Sinclair Oil & Gas acquired 150 net producing oil and gas wells and 5,600 acres in 16 West Texas counties through purchase of the Eastland Oil Co. of Fort Worth. Current production totals 1,600 bbl. of oil and 3,000,000 cu. ft. of gas daily. Sale also included 4,400 acres in Mississippi and 500 acres of undeveloped leases in West Texas. Purchase of the 37-year-old company boosts Sinclair investments in Texas above $400,000,000.

Murphy-Canada Oil Co. has acquired the Vigor Oil Co., a 30-year-old independent marketing company with gasoline and fuel outlets serving the Toronto and Oshawa area. The company operates a lake front terminal at Oshawa. Murphy-Canada is an affiliate of the Murphy Corp. of El Dorado, Ark.

Atlantic Refining has purchased 1,329,684 acres of oil and gas leases in the Northwest Territories from Glacier Explorers of Toronto. The acreage is in the Peel Plateau-Lower McKenzie River area about 100 miles north of the Norman Wells field. Atlantic currently is using two surface geological parties on the tract and will assign a seismic crew there this winter. Last February, Atlantic acquired another tract of 1,393,902 acres from Glacier.

Bandini Petroleum, Los Angeles, plans to acquire Long Shot Oil Co., Ltd., a Texas producing company, in a stock swap. Long Shot has producing properties in the Foster and North Cowden fields of West Texas and the Rhodessa and Gretchen fields in East Texas. It produces about 360 bbl. of oil daily. Also involved are Long Shot's acreage holdings in Noble County, Oklahoma. Bandini stockholders on August 19 will be asked to approve increasing Bandini's stock from one million to two million shares. There now are 720,000 shares of Bandini common stock outstanding.

A break-in period of operation preliminary to full-scale production was scheduled last week for the new $12,000,000 government helium plant at Keyes, Okla. The plant, with the Bureau of Mines as operator, can produce 290 million cubic feet of helium a year.



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LAST BIRTHDAY cake, topped by a big "90," stood beside M. L. Benedum in Pittsburgh when this photograph was taken on July 16. At right is Paul G. Benedum, his nephew, and on the left is Paul G. Benedum, Jr.

Mike Benedum—Wildcatter

KING of the Wildcatters, they called Mike Benedum. And he earned the title by finding more oil in more places than any other man in history.

Clinching the title, most of his big discoveries were in areas that had been condemned or abandoned by major companies.

Furthermore, he was nothing but a wildcatter. His usual pattern of operating was to sell out to a major and then start over again in some unlikely spot.

Many times in his more than 60 years as an active independent, Mike Benedum could have retired with a fat fortune. But he kept on hunting oil because that's what he liked to do. It was a challenge—his wit against Nature. His greatest thrill in a new strike was the thrill of achievement, the satisfaction that he had unlocked another secret from the earth.

Guesswork to science . . . Michael Late Benedum was born in Bridgeport, W. Va., July 16, 1869—just 10 years after the Drake well launched the oil industry.

His 90 years of life spanned every important development in the industry's technology, geographic spread, and method of operating.

His first wells were located by "creekology," Indian signs, and a blind man's "vision," but he was among the first to put reliance in geology, the seismograph, and other scientific oil-hunting tools as they came along.

He maintained a running feud with Rockefeller's old Standard Oil Co. and its successors, and took great delight in putting the screws to them in every possible deal.

But many of the properties he sold to these companies turned out to be among their largest and most profitable reserves. More than one major has acknowledged its debt to Mike Benedum for the lessons he taught in the faith and courage needed to find oil.

Flour to oil . . . Politeness put Mike in the oil business at the age of 21. In 1890 he gave his seat on a crowded railroad car to an official of South Penn Oil Co., one of the Rockefeller companies.

The man was so impressed with his personality that he offered him a job as landman. Mike had hardly heard of the oil business but it looked so intriguing he resigned a good job as manager of a flour mill.

For the next 5 years he bought leases for South Penn in the Appalachian area. He also traded in leases and royalties on his own and in cooperation with a South Penn engineer, Joseph C. Trees.

One day he paid a high price for what he considered prime acreage and it was hinted that some of the money was lining his own pockets. He resigned in indignation, took Joe Trees with him, bought the leases himself for $7,500, and began drilling them.

They produced handsomely, but then South Penn began offsetting them, two wells for one. Other independents rallied to the financial support of a man who would stand up to Standard Oil, and finally South Penn surrendered and bought those leases for $400,000.

Thus was launched the famous wildcatting team of Benedum and Trees. It was a loose partnership, and each partner often undertook a venture independently when the other was hesitant to go along.

I. T. and Illinois . . . Benedum and Trees operated with much success in the Appalachian region until Spindletop and the Mid-Continent discoveries showed men that oil could be found elsewhere.

They made a small discovery in Indian Territory in 1904, sold out at a profit, and went to Illinois which had no production whatever.

Around Robinson, Ill., they leased 50,000 acres in territory that had just been condemned by Ohio Oil Co., (a Rockefeller company) drilled several big discovery wells, and sold a majority interest in the properties to Ohio Oil for a profit of $8,000,000.

Other operators were abandoning Caddo Lake, near Shreveport, La., in 1907 because high gas pressure blew out the soft caprock and cratered the wells. The partners accepted the challenge. Joe Trees, the engineer, thought of the idea of drilling almost to pay, filling the hole with cement, and redrilling. It worked. The wells could be completed and controlled, and were prolific oil producers.

Most of the land around Caddo Lake had been leased by Benedum and Trees, but Gulf Oil Corp., to the astonishment of the entire industry, leased the lake, developed overwater drilling methods, and began offsetting.

Worse, Standard Oil, which provided the only market outlet, refused to purchase crude. So Benedum built pipelines, rounded up tank cars, found purchasers, and threatened to start an

integrated company. Again Standard capitulated and bought control for $6,000,000.

Mexico was the first foreign country to interest American oil men, and Benedum and Trees were in there early and with their usual success.

But then they learned that Jersey Standard had turned down the De Mares concession in Colombia so they made a deal for it, formed Tropical Oil Co., drilled the discovery well in 1918, and sold out to Standard for $33,000,000 in stock of International Petroleum Co.

Fling at integration . . . It was in North Texas that Mike Benedum made his biggest mistake.

The Ranger boom during the oil-short war year of 1918 was such a center of attention that no one seemed interested in a small oil show in a water well at Desdemona, only 13 miles away. Trees wasn't interested, but Benedum leased the area and brought in a discovery that rivaled Ranger.

But then Mike decided he wanted an integrated oil company. He spent $23,000,000 putting together Transcontinental Oil Co. in 1919 to handle Desdemona and other properties. But shortly afterward the bottom fell out of the oil business, and Transcontinental was deeply in the red for years.

It was salvaged by Big Lake, the discovery well of the great Permian basin in remote West Texas.

A local independent had one small well at Big Lake but no money for development, and all the big companies refused to show any interest. After once refusing, Benedum took a chance, formed Plymouth Oil Co., leased 10,000 acres, and agreed to drill eight wells.

All eight were uncommercial. Then Benedum drilled a ninth, and it came in at 5,000 bbl. per day in 1924. Big Lake became West Texas' first and one of its biggest fields.

Even more fabulous was Benedum's discovery of Yates field, the biggest of all in West Texas, in 1926. Transcontinental had leased the Yates ranch, but the adjoining ranch had just been abandoned by Ohio Oil Co. after drilling only dry holes.

Benedum would have pulled out then, too, except that one of his men had given Yates an oral promise to drill. The first well hit, and Benedum traded out Transcontinental for $60,000,000 of Ohio Oil Co. stock.

Failures, too . . . The list of Benedum's rank wildcat discoveries and the areas in which he made them covers most of the major producing areas of the world.

But he also had his share of failures.

In 1907 he sank $50,000 in a dry hole in Oklahoma and abandoned the lease. If he had drilled 130 ft. deeper, as someone else did 5 years later, he would have discovered Cushing field.

And when Old Ocean field on the Texas Gulf coast was discovered at 8,600 ft., Benedum recalled that 10 years earlier he had leased the whole area but abandoned his test well at 6,000 ft.

Mike Benedum was a sharp trader but always a gentleman and always a man of his word. He never swore, and he never bet or gambled on anything except an oil venture. He always made it possible for employes to buy stock in any of his companies and share in his successes.

Except for his Transcontinental venture he resisted the urge to be an empire builder and was content to retain an interest in producing companies with the management delegated to others. Among the more prominent of these today are Benedum-Trees Oil Co., Plymouth Oil Co., Hiawatha Oil & Gas Co., Mel-Ben Oil Co., Penn-Ohio Co., and Bentex Oil Co.

Until a few months ago Benedum retained an active personal interest in his properties and in the progress of oil exploration. He was feeling bad when he celebrated his 90th birthday July 16. He died at his home in Pittsburgh July 30.

Mike Benedum's philanthropies were as widespread and as lavish as his oil discoveries. A foundation established in memory of his only son, killed in World War I, has aided two dozen private colleges in the Ohio-Pennsylvania-West Virginia region. In has home town of Bridgeport, W. Va., he built a Methodist church, a library, a community center, and other facilities that are architectural and civic monuments.

In recent years few oil men have known Mike Benedum personally. But there is hardly an oil man anywhere in the world whose job is not in some part an outgrowth of Mike Benedum's lifelong quest to unlock the secrets of oil in the earth.

PROCESSING BRIEFS . . .

Du Pont Co. will build its second major polyethlene resin plant at its Victoria, Tex. works. Construction will be by the Du Pont engineering department and completion is scheduled early in 1961. Its main polyethylene plant is at Orange, Tex. The Victoria works, operating since 1951, produces adiponitrile, an intermediate used in nylon manufacture.

Shell Chemical Corp. will install a cobalt-60 irradiation unit at its synthetic-rubber division research laboratory in Torrance, Calif., this week. The unit will be used to study improved rubber and plastic products and in the development of radiation-resistant products for atomic power plants. The 2-lb. package is being shipped from Philadelphia enclosed in 13 tons of steel-covered lead shielding.

A new unit for recovery of propylene, for use in making petrochemicals and high octane gasoline blending components, has been placed on stream by the Texas Butadiene & Chemical Corp. at its plant near Channelview, Tex. The unit is the first to recover propylene in the effluent from the Houdry butane dehydrogenation process. The propylene will be supplied to other petrochemical producers or used as feed stock by TBC in its aviation alkylate operation.

A $9,000,000 gas-processing plant will be built in the Dick Lane gas field of Central Alberta, 110 miles north of Calgary. It will be operated by British American Oil Co., Ltd. Canadian Husky Oil, Ltd., Phillips Petroleum Co., and California Standard Co. have interests. Gas is under contract to Trans-Canada Pipe Line.

Also for Refiners...

IN THE NEWS: Increased demand for petroleum products and greater refinery runs are among factors responsible for good first-half profit performance of oil industry (p. 57) . . . Median income for professional engineers has reached record $10,000 annually (p. 69) . . . Davison Chemical now making quarterly report to refiners on catalyst quality (p. 75) . . . Venezuelan Government disturbed by East Texas crude price cut (p. 79).

PLUS THESE TECHNICAL REPORTS: New isom process gives octane improvement at 5-10 cents per octane-barrel (p. 90) . . . Systems engineering will be boon to processing plants (p. 93) . . . Light-ends fractionating at Phillips' Sweeny refinery (p. 115).

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Catalyst Quality Compared

. . . by refiners through Davison Chemical's new quarterly report. It's based on 71 fluid units in U. S. and Canada.

U. S. or Canadian refiners can now get a look at how the quality of their fluid cracking unit catalyst stacks up with the competition.

A check on the composite quality of catalysts is provided by Davison Chemical Division of W. R. Grace & Co. The firm has started a quarterly report on catalyst quality in operating fluids.

The reports are based on laboratory analyses of samples from 71 fluid units in the U. S. and Canada.

Individual conditions will determine to a large extent how a refiner operates his unit. However, by using the report as a gage, he can determine where he stands with regard to the composite sample. If he's too far in left field, a reevaluation of why he's there could save him money and headaches.

Davison's first report covers the February-April quarter, the previous 3 months, and the February-April quarter of last year.

Activity and surface area data showed no significant change over the past year, and no seasonal change is noted. Vanadium, nickel and copper contaminants have decreased slightly, while iron and sodium contents increased.

The over-all effect is probably due to the combined effects of decreased fresh catalyst consumption (constant activity and higher iron and sodium levels) and improved cat cracking feed quality (lower vanadium, nickel and copper in the face of the lowered fresh catalyst consumption).

Operating variables and differences in feed necessitate reporting the catalyst properties across a broad range. Davison has also digested this data to present mean values for each individual property. This doesn't imply, of course, that these are the most desirable levels of operation. However, they should be a true reflection of changing trends in the operation of fluid units.

The increased use of feed desulfurization and treating equipment, the use of coker gas oil as feed, changes in crude types, changes in fresh catalyst consumption and quality, and changes in product demand are some of the complex variables whose net effect on cat-cracking operations are indicated by the catalyst quality comparisons.

First Catalyst Quality Report

	Feb.-Apr., 1959		Nov. '58-Jan. '59		Feb.-Apr., 1958	
	Mean	Range*	Mean	Range*	Mean	Range*
Activity						
Davison D+L	29.2	24.0-34.4	29.9	24.6-35.2	29.5	24.4-34.6
Surface Area						
M^2/gm.	117	71-163	119	70-167	115	70-160
Metal Contamination						
Vanadium, p.p.m.	215	44-1,053	196	43-919	259	43-1,571
Nickel, p.p.m.	83	15-453	71	12-434	107	20-585
Copper, p.p.m.	4	0.3-38	3	0.3-36	5	0.5-52
Sodium, p.p.m.	556	104-3,079	527	74-3,153	497	82-2,968
Iron, wt. %	0.37	0.10-1.39	0.33	0.11-1.04	0.32	0.10-1.05

*95% of fluid units tested fall within these limits.

Northern Natural Expanding

. . . service to 342 communities in six states. Only part of construction will be started this year.

NORTHERN Natural Gas Co. has received Federal Power Commission authority to extend gas service to 342 communities in Minnesota, Iowa, Wisconsin, South Dakota, Nebraska, and Illinois.

The expansion, costing about $114,618,000, includes 430 miles of 20, 24, and 30-in. main pipeline; about 2,178 miles of branch lines; and 57,400 hp. in additional compressor capacity.

Because of the lateness of the FPC action, Northern Natural said much of the work would have to wait until next year. With the construction season half over and the steel strike in progress, only the Duluth-Superior extension will be built immediately.

Contracts to lay this 168 miles of 20 and 24-in. have already been awarded to R. H. Fulton & Co. and Williams Brothers Co. pipe and other materials have been delivered for this project.

The FPC also authorized Iron Ranges Natural Gas Co. to construct a new pipeline system in Minnesota to receive gas from Northern Natural and to serve 28 communities and several industrial concerns.

Iron Ranges proposes to construct about 180 miles of pipeline ranging from 3 to 12 in. in diameter. Cost of the project is estimated at about $7,614,600.

Both projects were approved with rate conditions.

Related action . . . Related proposals by El Paso Natural Gas Co., Permian Basin Pipeline Co., and Phillips Petroleum Co. also received FPC clearance.

Permian was authorized to increase its deliveries to Northern Natural by 50,000,000 cu. ft. daily, boosting the volume involved in their existing transportation-exchange agreement to 475,000,000 cu. ft. daily.

El Paso will be allowed to increase deliveries to Northern Natural by 50,000,000 cu. ft. daily, with gas to be purchased from Phillips. At the same time Phillips was authorized to abandon the sale of 50,000,000 cu. ft. daily to Northern Natural.

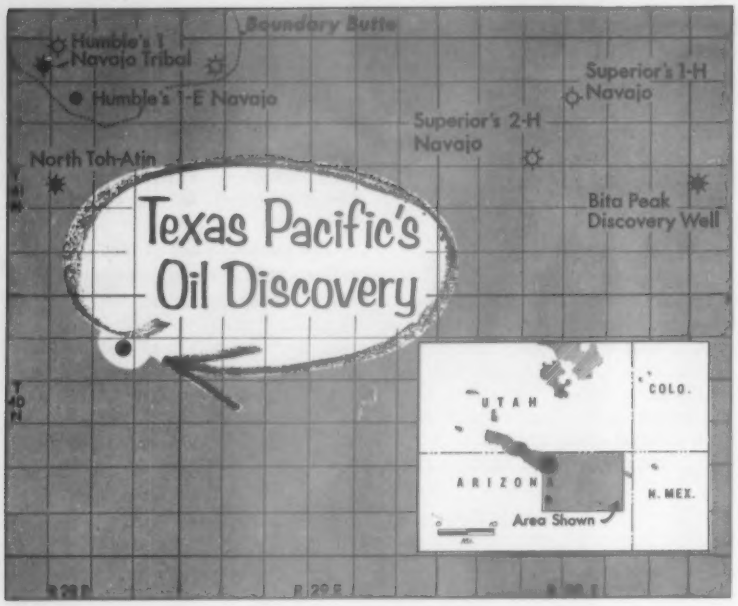
Service to the 342 communities would represent a third-year contract demand volume estimated at 230,899,000 cu. ft. per day.

Construction Firm Organized

A NEW company, Stanley-Bledsoe Corp., has been organized by C. C. Bledsoe, president; R. C. Stanley, vice president; and Cecil Powers, secretary, to handle all phases of pipeline work.

The company has thus far specialized in internal coating, having had contracts for several hundred miles of line. Work is now under way on 86 miles of 18-in. in Louisiana and 90 miles of 16-in. in Georgia for Southern Natural Gas.

Bledsoe is vice president of Midwestern Constructors, Inc., Tulsa, and Stanley is superintendent. An affiliated firm, Midwestern-Walco Constructors, is being liquidated. Its three spreads of equipment are being sold at auction.



Arizona Gets Third Oil Well

. . . with discovery in Apache County by Texas Pacific. It also is state's first production from the Mississippian.

NEW OIL discovery in Arizona gives that state its third field, its third oil well, and a deeper producing horizon.

It is in northern Apache County, in the northeastern corner of the state at the southern edge of Paradox basin of the Four Corners area.

Discovery well, drilled by Texas Pacific Coal & Oil Co., is completed on the pump making 240 bbl. of oil and 27 bbl. of water daily from perforated interval at 5,566-89 ft. in the Mississippian section.

This is the first commercial production of any kind in the state from the Mississippian. All previous production has been from the younger Pennsylvanian formation. Humble Oil & Refining Co.'s 1 Navajo (4-41n-28e) found Mississippian oil at 5,570-82 ft. but it has not been produced.

Location of the discovery well, 1 Navajo Tract 188, in 11-40n-28e, is 8 miles south of nearest production at Boundary Butte, the state's initial field which straddles the Arizona-Utah line. It is 15 miles southwest of Bita Peak, the state's other field.

First production . . . Boundary Butte, previously productive in Utah, was extended into northern Arizona in 1954 as the state's first production.

Discovery well, drilled by Shell Oil Co., produced gas. Later, in 1955, Humble completed a high gas-ratio oil well ¾ mile southeast of the Shell's gas-discovery well as the state's first oil production.

The state's second, and best oil well, also drilled by Humble, is located a mile south. It was completed last September with a daily flow of 1,044 bbl. of 42.5°-gravity oil from the Pennsylvanian Hermosa limestone at 4,600-75 ft. Other wells at Boundary Butte are completed in the Paradox zone.

Bita Peak, the state's second field, located near the New Mexico line, was discovered by El Paso Natural Gas Co. in August 1956 with gas production from the Pennsylvanian Paradox zone at 5,058 to 5,105 ft.

Texas Pacific's new discovery is in the center of a 2,357-acre tract owned jointly with Monsanto Chemical Co., Pure Oil Co., and Sun Oil Co. Texas Pacific, the operator, also owns a third interest in another four-section tract 15 miles west, and a half interest in a similar block south of the discovery tract.

Deep Oklahoma Test Is Dry

OPERATIONS have been suspended in Oklahoma's second deepest test.

Howell, Ellison and others' 1 Anadarko Basin, in 4-9n-12w, 15 miles northwest of Fort Cobb, in Caddo County, reached a total depth of 21,021 ft. That is 2,981 ft. short of the 24,002-ft. record recently set by Shell Oil Co. in its 5 Rumberger at Elk City in Beckham County, 50 miles west.

Bottom of the hole is in the Bromide formation of the Ordovician-Simpson section, well below the Pennsylvanian-Morrow horizon reached in Shell's Elk City test.

Hole is cased with 9-in. pipe to 17,447 ft. and 7-in. liner to 21,010 ft. Although no commercial production was proved, promising gas showings were encountered. Various sands were tested in a succession of perforated intervals below 15,000 ft.

Gasoline Tax Hike

. . . still not dead as GOP leaders echo Ike's dislike for bond-issue plan.

HIGHER gasoline taxes may prove to be the only alternative to a sharp cutback in the federal highway-building program.

The bond-issue route, approved by the House ways and means committee, is viewed as "quite unacceptable" by the Senate GOP policy committee. This appraisal came from Senate Republican leader Everett M. Dirksen of Illinois shortly after a meeting with President Eisenhower last week. It was interpreted as a White House threat to veto the deficit-financing bill if it passes Congress.

The ways and means plan calls for issuance of up to $1 billion in revenue bonds to help finance highway construction. Bonds would be repaid from the highway trust fund, which would be bolstered by transferring to it about $250 million a year for 4 years from automobile excise-tax receipts.

A slowdown in highway construction was envisioned by committee members as a part of the substitute plan to avoid a gasoline-tax increase.

Federal highway allocations for next fiscal year would be reduced from the proposed $2.5 billion to about $600 million. Allocations would rise to about $1.4 billion the following year, and "temporary" taxes going into the highway trust fund would be extended 4 years—to 1966.

Cutback seen . . . If a bond issue is "unacceptable" to the President as well as the GOP policy committee and if Congress refuses to raise gasoline taxes, then a much sharper cutback in highway construction is in prospect.

Administration officials have warned that under present legislation no apportionment can be made for

the interstate highway system for next fiscal year. They estimate about $500 million could be apportioned for the following year.

President Eisenhower has not ruled out the possibility of a compromise in his proposal for an increase of 1.5 cents per gallon in the gasoline tax.

There was renewed talk in Congress last week of another substitute plan, perhaps involving an increase of 0.5 to 1 cent per gallon in the gasoline tax.

Depletion Study Halted

THE HOUSE ways and means committee has canceled—at least temporarily—its study of a bill defining the application of the oil and gas depletion allowance.

Chairman Wilbur Mills (D-Ark.) stressed, however, that elements of depletion will be considered by the committee this fall when it holds hearings aimed at general overhaul of the federal tax structure.

Legislation defining the traditional scope of the 27½% depletion rate was sought by Secretary of the Treasury Robert B. Anderson several months ago. It would prohibit application of the depletion allowance on income derived from finished petroleum products.

Anderson's recommendation came after a district court upheld the right of La Gloria Oil & Gas Co. to take advantage of depletion in the sale of cycling-plant products. The Fifth Circuit Court of Appeals has reversed the decision, holding that La Gloria was not entitled to depletion.

New Texas Gas Tax Approved

. . . by legislature and goes to governor for his signature. Court test of bill by pipelines or others is expected.

THE TEXAS legislature finally emerged from a 194-day tax deadlock when the house agreed 115-25 to accept a Senate-approved $185,000,000 tax bill.

The bill, which includes a new levy on the first purchaser (severance beneficiary) of natural gas at a rate of 1.5% of value, will retire a $34,000,000 deficit and finance state operations for fiscal 1960-61.

It is a lead-pipe cinch to be signed by Gov. Price Daniel. Daniel fought for the new gas tax through a general and three special sessions of the legislature. Though the tax is smaller than he would prefer, the fact that it was passed at all is a victory for the governor.

The new gas tax will raise $7,800,000 a year or $15,600,000 over the biennium. It will go into effect September 1 in that both houses were able to muster a favoring two-thirds majority.

The new tax is defined in the bill, the biggest tax measure ever passed by the Texas legislature, as a "tax on the occupation or privilege of obtaining the production of 'dedicated' gas. . . ."

Provisions . . . If the producer sells his gas under contract to someone else, that someone else is the beneficiary. This generally means the pipelines. But the bill will also hit some utilities and industrial firms which buy gas direct from producers.

The tax cannot be deducted from payments to the producer or otherwise passed back to him.

It will apply at the wellhead except where liquids are later extracted. Then it will be levied on the value of the dry gas.

Gas would be exempt if reinjected, legally flared or vented, used for gas lift, consumed in lease operations, consumed as plant fuel or lost in extraction of liquids, or used in irrigation operations.

Legislators, following the governor's signature, will be watching to see how pipelines and others hit by the bill will react.

If this bill fares like the legislature's last effort to tax the long lines, some of the tax payments will be paid under protest and efforts will be made to knock it down in court as an unconstitutional burden on interstate commerce.

Texans feel this time they are on firmer ground, however, in that gas consumed intrastate would be hit as well as that crossing the state line.

A last-minute amendment to the bill in the Senate provides that the tax will fall in its entirety if it should prove partly unconstitutional—as on the interstate pipelines.

PIPELINE BRIEFS . . .

Contract to build an 84-mile 12 and 14-in. crude line in Argentina has been awarded to Sharman, Allen, Gay & Taylor, Houston. The line will be built for Pan American International from Comodoro Rivadavia field to the Atlantic Coast. Initial capacity of 12,600 bbl. daily may be increased to 50,000 bbl. daily.

A 371-mile 30-in. looping program in six sections along the 1,400-mile Texas Illinois Natural Gas Pipeline has been filed with FPC. The $43½-million expansion will enable Texas Illinois to increase capacity by 16%, or 85,000,000 cu. ft. daily.

Some 45 miles of lateral lines will be laid to pick up gas supplies in Arkansas, Brazoria, Calhoun, and Galveston counties, Texas. A 6,700-hp. compressor station is planned in Victoria County, Texas.

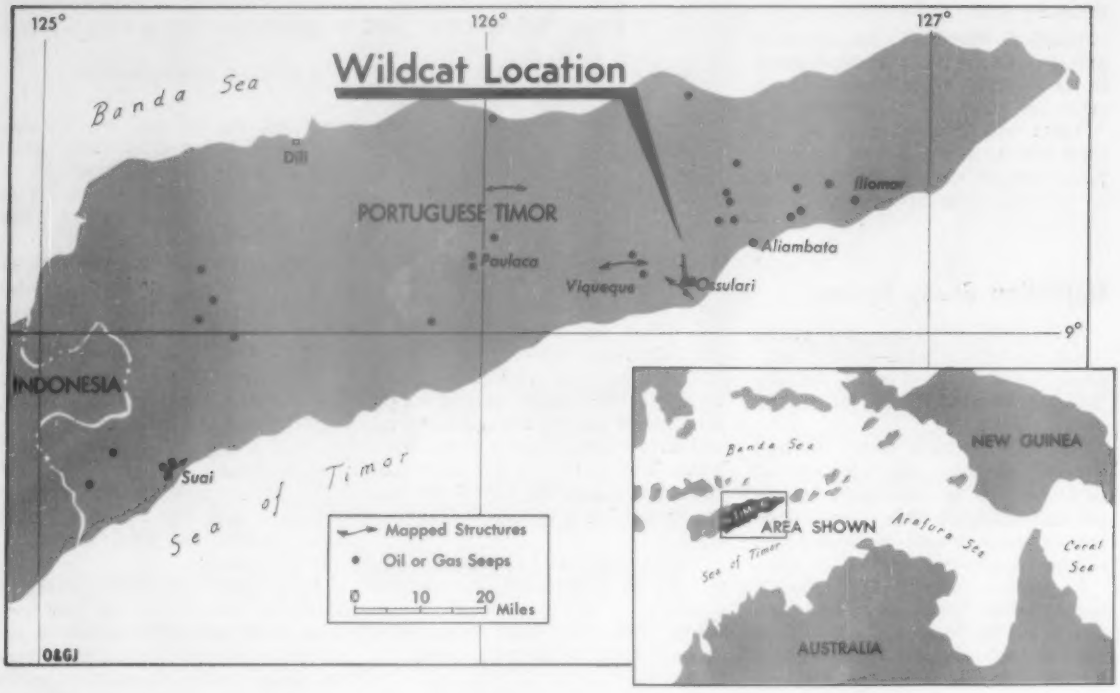
Contract to lay 42 miles of 20 and 24-in. in Texas has been awarded to H. B. Zachry Co., San Antonio by Humble Oil & Refining Co. The gas line will be laid from Humble's King Ranch plant to Alazan Creek. Completion is planned by September 10.

A new labor contract negotiated by the Operating Engineers of Niagara County, New York, will boost principal operator rates above $4 next year. The Pipe Line Contractors Association reports the contract negotiated with the Builders Association of Niagara Falls provides for a wage increase of 20 cents for 1959 and another 20 cents starting May 1, 1960, plus 10 cents in welfare benefits. Principal operator rates for 1960 will be $4.17½ an hour.

Also for Pipeliners . . .

IN THE NEWS: Texas Eastern's gamble with single giant compressor unit without standby capacity is paying off (p. 58) . . . Phillips files 140-page brief blasting Zwerdling decision and appealing the ruling to full FPC (p. 62) . . . Westcoast Transmission's new 30-in. line taps new gas in British Columbia (p. 68) . . . Northern Natural is expanding gas service to 342 communities in six states (p. 75).

PLUS THIS TECHNICAL REPORT: The why and how of mass-flow measurement (p. 87).



Wildcat Planned on Far East Island

● Two U.S. companies and Australian firm to explore island, where seeps have been known for years.

A WILDCAT will be spudded this week on Timor, an island off the north coast of Australia.

The well will be drilled on a 7,000-sq.-mile concession held by Timor Oil, Ltd., an Australian firm. The concession is in the Portuguese portion of the island. Portugal controls the eastern part of the island and Indonesia the western part.

Two American companies acquired a 50% interest in the concession earlier this year. They are Tradewinds Exploration, Inc., Denver, and Sunset International Oil Co., Los Angeles. Tradewinds picked up the half interest by agreeing to drill 15,000 ft. of hole on the concession. Sunset is participating by virtue of a substantial stock interest in Tradewinds plus a direct buy into the play. Tradewinds holds 45% of the interest and Sunset 5%.

Timor Oil, which has held the concession since 1956, abandoned a well early in 1958 in the Aliambata area at 4,165 ft. The company reportedly found good shows in the well before it was stopped by lost-circulation problems.

THREE NATIVES bail oil from a seep on Timor Island. This seep produces about 3½ bbl. of 33°-gravity crude daily. The seep is one of several on the island.

The first joint test will be drilled on the Ossulari structure. This is a 5½-mile by 3-mile anticline located on the south coastal plain on the eastern end of the island. Projected total

depth of the test, 1 Ossulari, is 7,500 ft. The operators expect that depth will give them a look at the Tertiary as well as about 5,000 ft. of Triassic limestones.

Additional geological and geophysical studies will be made to locate two additional wildcats. Preliminary work indicates one will probably test the Viqueque anticline located 7 miles northwest of the Ossulari anticline. The third is tentatively scheduled for an anticline on the west end of the island.

Drilling will be done by Roden & McRae, the drilling division of Tradewinds. An 8,000-ft. Brewster N-55 rig, part of $1.5-million worth of equipment owned by Timor Oil already on the scene, will be used by Roden & McRae.

On trend . . . Portuguese Timor is on the trend with the major oil fields of Sumatra and Java. The concession is roughly 400 miles northwest of Darwin, Australia.

Natives on the island have bailed numerous oil seeps for years for light and heating purposes. One major group of seeps is at Aliambata on the south coast near the three companies' first wildcat. One group of seeps yields about 7,000 gal. per year.

On the west end of the Portuguese portion of the island, two seeps produce about 3.5 bbl. of 33°-gravity crude daily. These seeps occur in the Miocene and Eocene Tertiary rocks while those at Aliambata come from the Triassic. Two anticlinal structures have been mapped in the Matai region.

A wildcat drilled to 1,800 ft. in 1926 still produces a small amount of gas, oil, and salt water from the abandoned surface casing which sticks up about 3 ft.

East Texas Crude Cut Stirs Venezuela

THE 20-CENT price cut made 2 weeks ago by a minor purchaser of East Texas crude struck nerves all the way from Caracas to New York.

Those nerves were still jangling last week in spite of the fact that other buyers of East Texas oil have not met the price cut announced by Atlantic Refining Co.

Venezuela, supersensitive to price cuts since last spring's round of worldwide decreases, reacted even more than alarmed Texas independent producers. Both fear a spread.

A general East Texas price cut would mean a decrease in the tax money which Venezuela gets from at least part of its own oil. Atlantic's cut affects only about 5,000 bbl. of East Texas crude it buys, but the move was like a red flag in Caracas.

Officials of all the companies operating in Venezuela which produce or buy East Texas crude, or have affiliate companies that do, were called in by the government for conferences. Juan Pablo Perez Alfonso, Venezuela's new Minister of Mines and Hydrocarbons, along with top members of the ministry staff, wanted answers to a lot of questions.

The quick and positive reaction in Caracas is typical of the militant attitude of Venezuela's new regime toward its oil industry. Perez Alfonso has warned publicly that Venezuela wants to be consulted on pricing matters before changes are carried out. It was apparent last week he's making an effort to make those public utterances stick.

It is extremely doubtful that the Venezuelan minister's staff got detailed answers they wanted from these conferences. They asked oil company men for an "explanation" of Atlantic's action. Few oil men operating in Venezuela would feel free to offer an explanation for the actions of another company in the United States.

The ministry officials asked for detailed information on refinery margins for East Texas crude processing and other related marketing matters which few, if any, of the Caracas oil company representatives were able to answer.

Why the cut could hurt . . . The royalty or basic exploitation tax collected by Venezuela is not based on the prices for oil which companies post in Venezuela.

Price posting is a comparatively new practice in Caracas and the basis for the country's 16 2/3% royalty goes back much further. In fact, the companies have hoped in vain they could persuade the government to discard the old royalty formula by posting Venezuelan prices. So far, this has been without success.

The basis for this exploitation tax in Venezuela is the posted price for comparable crude oils produced in Texas. The higher gravity Venezuelan crudes are generally linked to East Texas postings and the intermediate crudes to West Texas prices. Royalty on some Venezuelan oils is fixed on a mixture of the two.

Royalty on the heavier crudes below 25° gravity is fixed by a complicated formula in which the price of Bunker C plays a part.

Each Venezuelan crude is classified by the ministry as similar to East or West Texas crude, or a mixture of the two. FOB price of the Texas crudes at the Gulf Coast then becomes the base for the similar Venezuelan crude at a Venezuelan port.

To arrive at a "field price" of the Venezuelan crude for tax purposes, the ministry then deducts the theoretical cost of moving the crude to the port. Companies say this is usually a somewhat arbitrary figure based on an "as-the-crow-flies" distance from the field to the port.

U. S. reaction . . . Two weeks after the Atlantic cut was announced, it still had not been met by other East Texas purchasers.

It is generally conceded that with every passing day a general East Texas cut becomes less likely.

The East Texas crude went higher than others when European buyers moved into U. S. markets to get crude supplies when the Suez crisis cut off the Middle East. It is the only crude which has not since had a downward adjustment. But, it was apparent last week that not all companies feel as strongly as Atlantic that it is now overpriced.

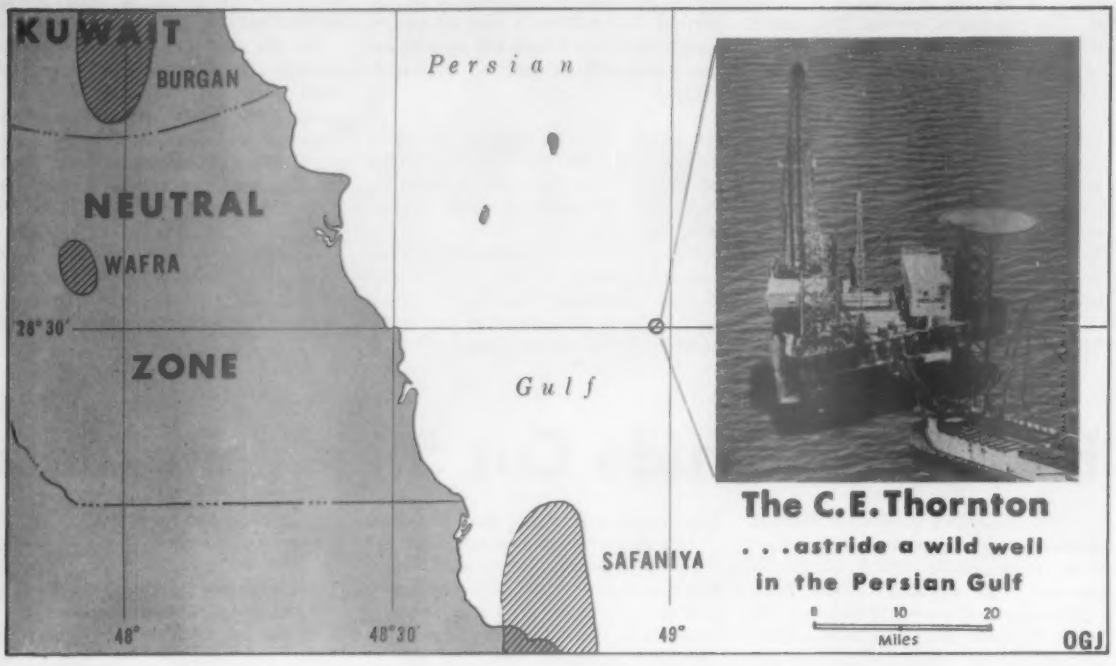
Several companies told the Journal "some people feel East Texas is a little high," but all conceded that no decision had yet been reached on meeting the 20-cent cut.

The high gravity, sweet East Texas crude now represents only 5.3% of the state's production (OGJ, July 27, p. 97), but there are still many individual contracts for avgas, JP-4, and other refined products tied in with the price.

If Atlantic's new price of $3.05 is not met by other East Texas purchasers, the company officials who are called upon to explain the action to Venezuela may be hard pressed to justify the new posting.

Since Atlantic itself produced about 9,000 bbl. daily in East Texas and buys another 5,000 bbl., the company can argue that it carries most of the weight of the cut itself.

But the Venezuelans are going to be hard to convince that Atlantic or anybody else should pay royalty on Venezuela crude classified as similar to East Texas on the $3.05 price instead of at $3.25.



The C.E.Thornton
. . .astride a wild well in the Persian Gulf

Wildcat Off Neutral Zone Blows Wild

- Houston fire fighter is called in after initial well on new Japanese concession hits high-pressure gas zone, blows out, and catches fire. Rig topples from American-owned mobile drilling platform.

THREE months ago a short, stocky Japanese drilling engineer leaned across a chart of the waters of the Persian Gulf, pointed to a dot and then looked up at a visiting American geologist from a neighboring oil field.

"Think we'll find oil there?" the Japanese asked quizzically.

Last week, T. O. Yozhizaki had at least a partial answer to his question. It was an encouraging, but extremely expensive answer.

After more than a year of preparation and only 2 weeks of actual drilling, the Japanese wildcat testing a new concession off the Kuwait-Saudi Arabia Neutral Zone drilled into a high-pressure gas zone, blew out, and caught fire.

At the end of the week, the rig had toppled from an expensive mobile drilling platform owned by an American drilling company, the well was burning fiercely, and $5 million worth of equipment was in jeopardy.

There was every indication that this was more than an isolated high pressure gas pocket. This was about the only encouraging factor in the whole situation for the Japanese.

The blowout came suddenly and without warning as the bit cut into the zone just below 1,500 ft. Blowout preventers were closed but the gas flow continued to flow around the 700 ft. of 20-in. surface casing. Two days later the rams on the blowout preventers were gone.

Fire fighter called . . . Last week, Paul N. (Red) Adair, Houston oil-well fighter, was on his way to the Neutral Zone to fight the blaze.

O. D. Blankenship, Rome, superintendent of International Drilling Co., and C. E. Thornton, Tulsa, executive vice president of Reading & Bates Offshore Drilling Co., were on their way to the scene.

International Drilling is the contractor on the well. The equipment is owned by Reading & Bates. The three-legged LeTourneau platform, which will be a total loss if the well craters, bears Thornton's name. The tender, which was towed out of the way when the well blew out, is the J. W. Bates.

Strategy in fighting the blaze was still a question last week. The shallow 1,500-ft. depth makes a relief hole impractical even if another drilling barge were available in the Persian Gulf to do the drilling. There is none except the Pan American International DeLong-type barge now being outfitted in Iran for an offshore test across the gulf. Two other barges in the gulf area are both occupied with drilling wells.

The high-pressure gas flow at such a shallow depth caused a great deal of industry speculation. The well is a rank wildcat and little is actually known of subsurface conditions or the stratigraphy in that area. It was widely assumed that the gas zone was in the Eocene because it was hit at such a shallow depth.

Eocene limestones are productive in both Iran on the east side of the gulf and in the Neutral Zone's Wafra field to the west. High pressures are common in Iran, but the 1,200-ft. Eocene pay on shore in the Neutral Zone has very little gas.

The well was spudded July 19 and the Japanese said at that time they expected to reach the Jurassic Arab zone, which is productive in Saudi

Arabia, within 90 days. The well was projected to 8,000 ft.

All-out try . . . The test represents an all-out effort on the part of the Japanese-owned and newly-organized Arabian Oil Co. to find sizable production quickly.

Since the company broke the traditional 50-50 profit split formula to get the offshore concession a year ago, it has been troubled by a lack of financial backing from the Tokyo industrial firms who first agreed to take an interest in the venture.

The Japanese offered Saudi Arabia and Kuwait a 57-43 split of the profits to get the drilling rights over the offshore area which is conceded to be a prime prospect.

The new company's paidup capital amounts to only $9.5 million. Its planned operations for 1959 will cost $12.5 million, including $3 million in rentals to Saudi Arabia and Kuwait.

The company expects to get supplemental backing from the Japanese Government and from banks.

Location for the first test was selected after some of the most intensive geophysical work ever done in the Middle East. The surveys were conducted from August to November last year. The 3,600 magnetic tape reflection records and 15,000 refraction spreads were fed into an electronic computer for interpretation and then location fixed.

The C. E. Thornton arrived in the Persian Gulf early in May after a rough ocean crossing which began last Christmas eve at Orange, Tex. The electrical system of the platform had to be almost completely rewired before the storm-buffeted equipment was ready for operation.

Unless the blowing well bridges and shuts itself in, or Adair is successful in snuffing out the fire quickly before it craters, the contractors face the almost certain prospect of losing the big platform.

Then, with the company's taste only whetted by the gas find, it will take at least a year to move new equipment into the area for a second well.

Creole Cuts Exploration

VENEZUELA'S new income tax law put a serious crimp in the investment program of Creole Petroleum Corp. the first half of the year.

Both crude production of 1,181,243 bbl. daily and refinery runs of 358,533 bbl. daily were higher than the first 6 months of 1958. But capital and exploration expenditures amounted to $43.4 million, compared with $82 million for the same period last year.

Creole's net income for the first half was $115.5 million, compared with earnings of $160.9 million last year. The 1958 first half earnings were later adjusted downward to $117.2 million as the result of the change in the income tax rates decreed on December 19.

Second Aussie Test

. . . staked by Delhi-Taylor north of present wildcat.

LOCATION for a second wildcat in the Great Artesian basin has been staked by Delhi Australian, Ltd.

The test will be drilled at Betoota, Queensland, about 12 miles north of the South Australia border, and 150 miles north of the company's first test under way at Innamincka. Betoota 1 will test a large anticline indicated by geological and geophysical surveys.

The Delhi-Taylor subsidiary is operator on concessions covering 97,000 sq. miles for itself, Santos, Ltd., and Frome Broken Hill, Pty., Ltd., which is partly owned by Stanvac and British Petroleum.

Betoota is one of four proposed wildcats which have qualified for government assistance. As a spur to exploration, Australia is chipping in up to half the cost of wells which give promise of significant new information.

The new well is expected to yield information on the Mesozoic sequence, and to penetrate a Paleozoic zone different from the sequence expected at Innamincka. The government will pay up to $337,000 for the test. It also is helping foot the bill at Innamincka.

Other proposed wells which are being subsidized include a wildcat at Rosedale, Victoria. Australian Paper Manufacturers, Ltd., will receive up to $108,000. Exoil, Pty., Ltd., will receive up to $17,000 for each of two tests in western Australia. One is at East Gambanga, and the other at Eucla Plain.

Have shows . . . Delhi was drilling ahead last week at 8,700 ft. at its Innamincka well.

This well, with a $716,000 Australian government subsidy, has penetrated thick beds of marine sediments and has had several shows of oil and gas in upper horizons. Drillstem tests of these zones, however, indicate that they are probably not capable of commercial production. It is projected to a total depth of 14,000 ft.

Test in East Libya

. . . slated by BP following three western dry holes.

AFTER three dry holes in western Libya, British Petroleum Co. is shifting its sights to Cyrenaica, where it will spud the country's most easterly well.

The wildcat will be located on Concession 37, about 200 miles southwest of Tobruk and an equal distance from the Egyptian frontier. Spudding in is scheduled for mid-October on a site in the middle of an uninhabited gravel plain. A heavy rig rated at more than 12,000 ft. will be moved in along mine-cleared tracks from Tripoli.

The test will be an effort to extend eastward the young North African oil province which already spreads for 1,000 miles across Algeria and Libya. Esso Standard's 17,500-bbl.-daily Zelten 1 discovery lies approximately 150 miles to the southwest. Three dry holes drilled in the coastal region by Libyan American Oil Co. lie to the northeast.

Rash of bidding . . . Esso's Zelten find has rekindled an interest in Libya's open acreage.

Less than half the country was under license at the time of the Zelten strike. Since then, new applications have raised the total land either awarded or sought to 60%. Several big-name companies are seeking open lands, including southern Fezzan, where a major pipeline system would be required to bring out crude.

Competition is expected to be especially hot for remaining acreage in Zone II, or Cyrenaica. There is only one open zone left, and this is along the Egyptian border.

New Line Links Cicuco Pool

A NEW pipeline loop will carry crude from Colombia Petroleum Co.'s Cicuco field to the Caribbean port of Covenas.

The 69-mile 12-in. loop is in the 263-mile 12-in. system of South American Gulf Oil Co., which is owned jointly by Colpet's parent firms, Socony Mobil Oil Co. and Texaco, Inc. The 20-year-old system has been the outlet for Colpet's Petrolea, Tibu, Rio de Oro, and Puerto Baro fields in the Barco Concession.

The loop has a capacity of 36,000 bbl. daily. The 3-year-old Cicuco field recently produced 18,700 bbl. daily from 15 wells.

Complete drilling and production facilities for a several-hundred-acre oil

Richfield runs a big-time operation

BY D. H. STORMONT
West Coast Editor

THESE HUGE 31-TON concrete tetrapods protect the seaward side of the island, breaking up the waves during times of heavy seas.

DEVELOPMENT at Richfield Oil Corp's. drilling island ½ mile offshore from Rincon, Calif., is progressing much the same as at any onshore site.

That it is reflects the careful planning which went into the design and layout of the drilling and producing equipment concentrated in the little more than 1 acre of working space.

All surface facilities for a several-hundred-acre oil field are squeezed into this small space—an area not much larger than 200 by 200 ft. Ultimately, 68 wells may be completed in a cellar that extends along the west side of the working area.

Facilities for lifting the oil, and for its separation, dehydration, and shipping, also are provided on the island. A compressor plant handles the produced gas, making it available for lifting weak wells, for reinjection, or for sale.

The island, built in 45-ft. water, is connected to shore by a 3,000-ft. causeway. Richfield spent almost $4,000,000 in completing the two structures.

Unique design . . . As the 1,175-acre lease was granted before steel platforms were authorized for California coastal waters, the island is composed entirely of rock and sand. About 40,000 cu. yd. of material was used in its construction. Huge concrete tetrapods fringe the seaward side and act as a buffer to heavy seas.

The island is built along the lines of an inverted filter. Huge rocks weighing 16 tons each make up the outer shell. Successive layers decrease in size until the core of sand fill is reached. This design permits the wave forces to be neutralized without any uplift. At the same time backflow is permitted without loss of the sand fill.

The island is built so that its seaward (west) side faces the direction from which heavy seas may be ex-

field are squeezed into 1 acre of working space off California coast as

on a postage-stamp-size island

pected. This area is built up 41 ft. above water level, with the rock facing protected by more than 1,100 31-ton tetrapods. To further protect against wave action, a 30-ft.-wide concrete-walled reinforcing section was built inside the rock barrier. The working portion of the island, most of which has been black-topped, has an elevation of 16 ft.

Drill site . . . Drilling is carried out over a concrete cellar, the seaward side of which is formed by the inner retaining wall. Conductor pipe for the 68 wells was driven into the ocean floor before the island was completed. These are placed in two rows, with a 5-ft. spacing between well centers.

As the seaward side of the cellar is about 10 ft. higher than the other, the substructure for the 136-ft. derrick was designed for this split-elevation situation. As shown in accompanying photographs, one side rests on the elevated retaining wall while the other rests on a 15-ft.-high subbase.

The elevated pipe rack extends the full length of the cellar, as also does the elevated mud ditch. The mud pumps, pits, and storage tanks are semipermanently located beneath the pipe rack. Drilling muds and chemicals, all of which are handled on pallets by a fork-lift truck, are stored beneath the rack also.

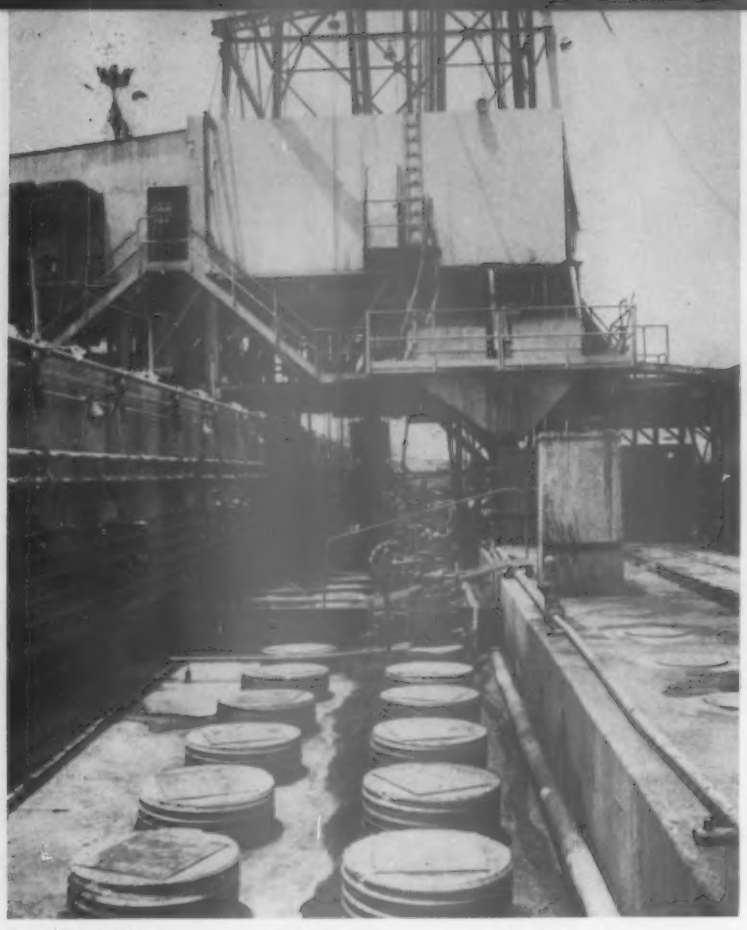
Mud, air, fuel, and water lines, as well as electrical conduits, extend the length of the cellar. Outlets are provided at 30-ft. intervals so that only short connecting lines are needed regardless of the rig's position along the cellar. These jumper lines are equipped with quick couplings, and all can be connected or disconnected by one man in less than 10 minutes.

Principal drilling equipment includes a National 50 draw works powered by two 600-hp. General Motors twin diesels. Two Oilwell 7¼ by 14-in. mud pumps are used, generally operating in parallel. Each is powered by a single and twin diesel, providing a 400-hp. input.

The 136-ft. derrick is equipped with a movable crown block which is easily shifted so that it can be centered over either row of wells. Its base is 27 by 30 ft., with the longer dimension spanning the cellar. Height of the kelly bushing is 25 ft. above ground level.

Rig moves . . . In keeping with the large number of wells to be drilled from the site, the rig is designed for rapid moves with all equipment intact. Average time required from completion of one well to the spudding of another has been about 8 hours. All moves are made by the five-man crew then on duty.

Preparatory steps taken to a move are quite simple. Using the kelly and a ¾-in. line strung over the derrick, the outer end of the hinged walkway is raised high enough (about 15 ft.)



THE LONG CELLAR may ultimately contain 68 wells. Conductor pipe for wells yet to be drilled is shown in the foreground.

to clear any pipe on the racks. The kelly is pulled up into the derrick and then all rig lines are disconnected from the cellar outlets. One set of lines used for skidding the rig also must be rigged up.

The entire structure is moved along the cellar by means of lines strung from the skid shoes to deadmen at each end of the cellar. Two 20-hp. motors, one mounted in the subbase beneath the derrick floor and the other in the drilling-engine sub, supply the power. Normally 11 lines are strung between the gear and chain-driven winches and the traveling block. Easily removed lengths of 2-in. cable connect block to deadmen.

Two skid shoes, 30 in. wide and extending the length of the base, carry the entire rig and derrick load. A third shoe and motor-driven winch are provided on the outer end of the drilling-engine sub but experience has shown they are not needed.

Rails are provided beneath the skid shoes but they serve as guides only. Cleats extending from the shoes ride clear of the rails as long as the skid is proceeding in the proper direction.

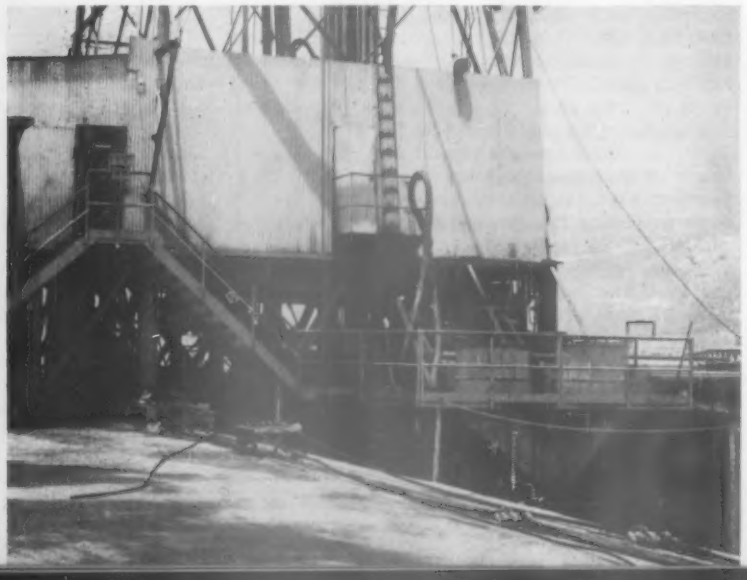
Drilling Practices . . . Of the 14 producers completed at midyear, all were slanted holes. Since competitive conditions exist, no information on their bottom-hole locations is being released at this time. The wells are bottomed at vertical depths in the range of 1,800 to 2,400 ft. Maximum horizontal displacement of any well is about 2,000 ft. The lease is to be developed to a spacing of 15 acres or fewer per well.

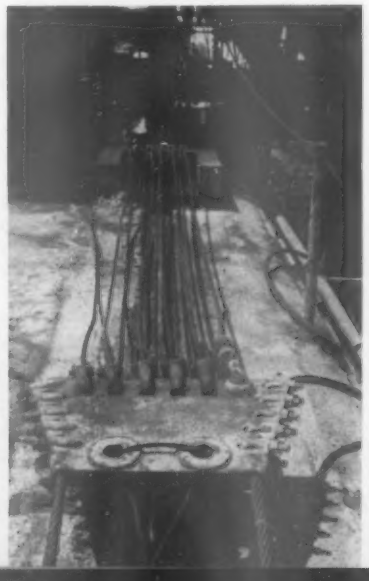
The practice followed is to drill an 18⅝-in. hole to about 300 ft. and set 13⅜-in. pipe. A 12½-in. hole is drilled to the top of the pay zone, and either a 7⅞ or 8½-in. hole carried to total depth. The reduced hole is then plugged back and 8⅝-in. casing set.

Fresh-water, lime-base mud is used in this portion of the hole and for drilling out the cement plug. This mud is displaced with an oil-base completion fluid for drilling a 7⅞-in. hole through the zone and in scraping the hole to 10¼ in. A 5½-in., 60-mesh slotted liner then is landed with approximately 150 ft. extending inside the oil string. Wells then are gravel packed with 6-9-mesh gravel.

The conductor pipe from which a particular well is to be drilled is selected so it fits into the development plan for the field. Not only is direction considered but also the horizontal

RIG MOVES are quickly made by this rigging, using motor-driven winches in the subbase to supply the pulling power. Aquagel is spread beneath the skid shoes to reduce friction.





PURCHASED ELECTRIC POWER is used for all production operations. These 75-hp. motors drive the triplex pumps used to supply some 900 bbl. of power oil to wells being hydraulically pumped.

ALL SHIPPING and other pumping is done with motor-driven equipment. Pumps are remotely started and stopped from the bank of explosionproof switches in the storage area.

distance the well is to be bottomed away from the drill site.

Since well circumferences are only about 3½ ft. apart in the top surface hole, extreme care is taken to keep it vertical. Deviation is kept within ¾° to the point at which the hole is kicked off vertical. In some wells the hole was kicked off at 150 to 180 ft., more than 100 ft. above where the surface pipe was set.

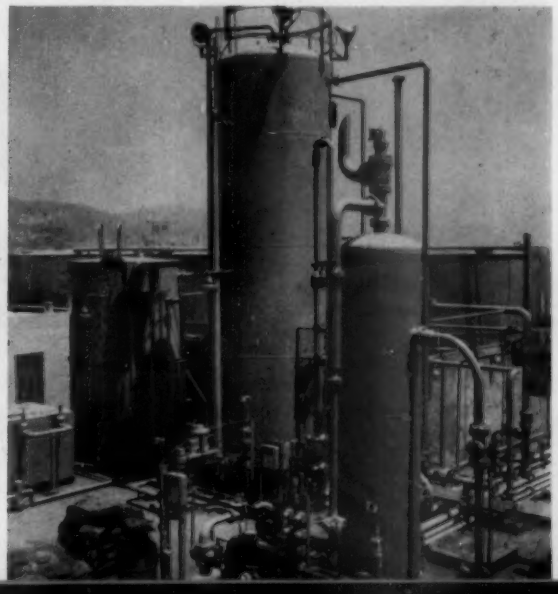
Before drilling is started the planned course of a well is plotted both vertically and directionally. During drilling the hole is kept within a 50-ft. radius of the planned course. Drift angle is picked up at the rate of 5° per 100 ft. until the desired slant is reached. In some wells the critical 65° angle has almost been reached.

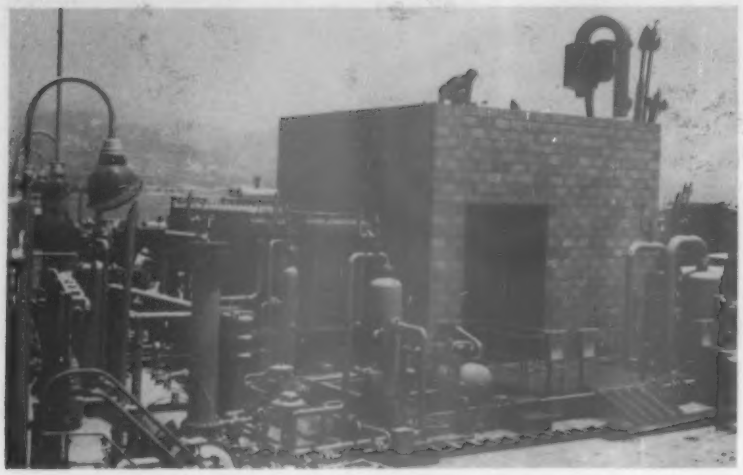
From experience gained in drilling more than a dozen Rincon wells, only two whipstocks now are needed for most holes. Occasionally more are re-

COMPLETING RINCON WELLS consists of connecting the wellhead to test and bulk production lines which extend the length of the cellar. Other lines include a salt-water fire line and two which handle the power oil for the closed system hydraulic pumping.

FIVE TEST LINES AND TRAPS are provided so that close check can be kept on an individual well's oil and gas production and per cent of water cut.

TRAP IN FOREGROUND receives oil from wells connected to the bulk production line. The heater-treater in the background is steam heated by a 100-hp. generator.





ALL GAS PRODUCED at Rincon is compressed either for gas lifting, sale, or reinjection. Vapor-recovery facilities on shipping tankage also supply gas to the compressors.

quired, particularly when a hole is slanted into a new portion of the structure. In some earlier wells it was necessary to set as many as six or eight whipstocks.

After the desired drift angle has been built up in a hole, the angle is maintained by varying the position of stabilizers in the drill string. In general practice about 160 ft. of 7-in. steel collars was run above the monel collars. Usually three or four stabilizers are used, spaced above, below, and in the collar string according to whether the drift angle needs to be reduced or increased.

Average completion time is about 12 days, of which about half is drilling time. Because pipe has to be pulled quite frequently to make adjustments in the position of the stabilizers, the bit actually is on bottom only about 6 hours of each day.

Aside from problems connected with slanted holes, Rincon drilling is classed as relatively easy digging. Poorly sorted sands make up most of the approximately 2,000 ft. of section cut by the average well. Before centrifugal desanding equipment was installed, sand content of the mud was running about 8%. Two desander pumps, powered by 15-hp. motors, now hold the cut to about 1%.

Producing facilities . . . As rapidly as one well is drilled, gravel packed, and placed in production, the rig is skidded over another conductor pipe and drilling resumed.

Wells so far completed, 14 on July 1, have all been low-volume producers. Their average initial production has been about 60 bbl. daily of waxy, 30°-gravity crude. Some are placed on the pump at the time of completion and others require installation of gas-lift equipment. Of those completed at midyear, seven were being hydraulically pumped and the others were flowing.

As accompanying photos show, flow lines are already in place along one wall of the cellar. Five 2-in. test lines are provided and one 6-in. group line. Wells on test flow to one of five test traps where oil and gas output is metered and a sample of the crude taken automatically.

Because congested conditions limit the amount of tankage for power-oil storage and cleanup, a closed system is used on the Kobe hydraulically pumped wells. Power oil to operate the subsurface pumps is circulated through lines separate from the produced oil.

Other producing facilities stationed on the island, most of which are shown in accompanying photos, include a vertical heater-treater, wastewater skimming tank, and two 1,000-bbl. shipping tanks. The latter are equipped for vapor recovery and for ground-level and remote gaging. Steam for the 3,000-bbl. heater-treater is supplied by a 100-hp. portable generator.

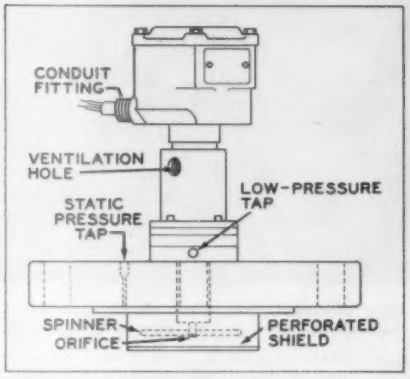
All possible precautions have been taken against a fire breaking out. Except for drilling equipment, electric motors are used as prime movers. (Power is brought to the island at 16,500 volts and reduced to 440 volts for distribution). All controls are mounted in explosionproof housings.

In the event fire should break out, high-pressure salt water is available at several points. A system of fog nozzles spaced at 10-ft. intervals completely covers the cellar.

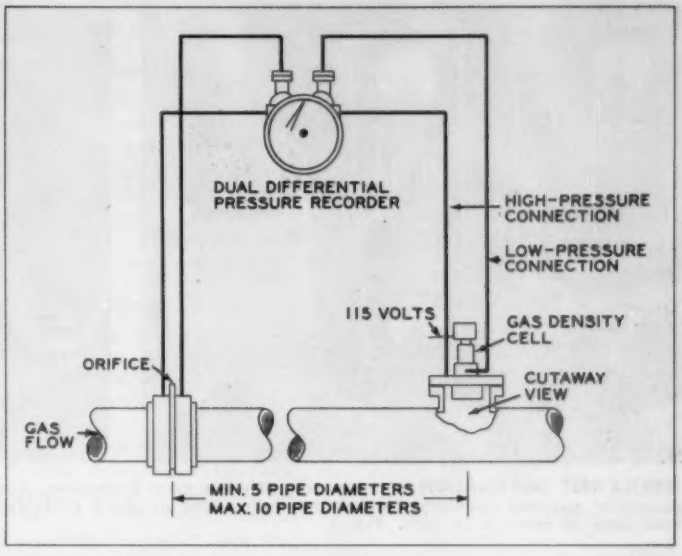
Precautions against water pollution have been given first priority. Drainage in the cellar is toward either end, where sump pumps pick up any accumulated fluid and move it to a sump. All salt water used in washing down the rig and cellar area thus is collected and hauled to shore in vacuum trucks. Cuttings and sand removed from the mud stream likewise are collected and hauled to shore for disposal.

Produced water knocked out in the heater-treater is disposed of in the ocean, but only after it has been thoroughly treated and skimmed to reduce its oil content to acceptable standards. That the entire operation has been beneficial to marine life and has in no way harmed it, is best illustrated by big schools of fish which now hide in the kelp that has accumulated around the island.

MUD RETURNS are secured using this device. Whenever rig is shifted above a new well, this length of pipe is lowered into the previously set conductor pipe. After extension has been lowered into conductor pipe, air pressure is applied to inflate tube and provide a seal.



CONSTANT-SPEED ROTATION of a spinner in measured gas creates a differential pressure between center and ends of spinner. This differential is converted to gas density. Fig. 1.



DIFFERENTIAL RECORDER records differential pressure from gas-density cell. Application of the cell factor gives gas density. Gas flow in pounds may be computed from Equation 1. Fig. 2.

Mass-flow measurement—Why? How?

"It makes sense to measure gas by weight instead of by volume"

By HARRY P. BEAN
Measurement Engineer
El Paso Natural Gas Co.

THE HEAT ENERGY in a pound of natural gas varies less with composition changes than does heat energy on a cubic-foot basis. For this reason it makes sense to measure gas by weight instead of by volume.

Three different methods of measuring weight of flowing gas have been field tested and proved accurate. However, they will require much more testing before they are universally accepted. Reliability and accuracy, acceptable now, will improve with experience and research.

The day will come when measurement of gas by the pound is commonplace.

Why measure mass? . . . Unfortunately, the amount of gas contained in the accepted volumetric unit of measure varies. Normally, the actual volume at flowing conditions is not used. Instead, measurement is based on some standard or base condition of pressure and temperature.

These standard conditions are anything but standard. For example, there are more than a dozen common pressure bases. Some companies, to comply with contracts and state and federal regulations, must compute volumes on as many as five or more pressure bases.

Mass measurement, or more correctly, measurement by weight, would eliminate the need to define these standard conditions. Indeed, gas can be measured by the pound without regard to pressure or temperature, either at flowing conditions or at some assumed base conditions. Also, heat energy of any given gas on a pound basis will be the same regardless of delivery conditions.

Another advantage of weight measurement over conventional volume measurement is the elimination of the need to determine specific gravity and supercompressibility.

Three different methods of weight measurement have been tested in the field. These are (1) mass flow with orifice meter, (2) vortex-velocity-type mass-flowmeter, and (3) velocity-change mass-flowmeter.

Mass Flow With Orifice Meter

The substitution of a density-measurement device in place of the static pressure element makes weight measurement possible with the familiar orifice meter (Figs. 1 and 2). The density cell may be simply a hollow spinner rotated at constant speed in the gas being measured. Centrifugal force creates a low pressure in the center of the spinner. The difference between the line pressure and pressure in the center of the spinner is directly proportional to the density (or more correctly, the specific weight) of the gas at flowing conditions.

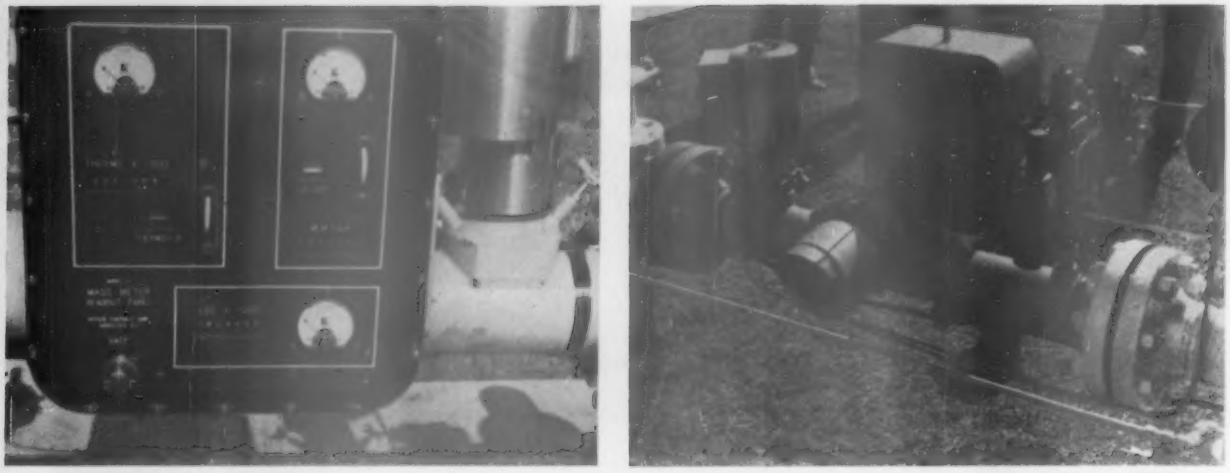
This is recorded on a standard differential-pressure recorder. Actually, the recorder consists of two differential-pressure recorders, one for specific weight and one for the orifice differential. Integration of these two records is performed on a standard integrator. The specific weight of the gas in pounds per cubic foot will be equal to the differential reading times a cell factor.

The gas flow in pounds may be computed from the equations shown on page 92 of AGA Report No. 3:

$$W_h = 1.0618\, F_c^{1/2}\, F_b\, F_r\, Y\, F_m \times (h_w h \gamma)^{1/2} \qquad 1$$

W_h = weight rate of flow in pounds per hour.

Paper presented at short course on gas technology, Texas College of Arts and Industry, Kingsville, Tex., 1959.



SERVICE TEST INSTALLATION of vortex-velocity-type mass flowmeter. Front view of panel, left, gives direct readout of pounds of gas and auxiliary totalizers for therms and standard cubic feet. Cylindrical unit is the density transducer. Rear view of panel is at right. Fig. 3.

F_c = density cell factor (a constant for each cell).
h_w = orifice differential pressure in inches of water.
$h\gamma$ = density cell differential pressure in inches of water.

The integrator constant and square-root chart factor (when required) must also be added to the equation. F_b, F_y, and Y are the old familiar factors for orifice meters.

The Reynolds number factor, F_r, and the expansion factor, Y, are functions of the orifice static and differential pressures. For convenience, tables could be prepared relating these factors to γ (the specific weight) and h_w. Similarly, F_m could be based on γ rather than P_f.

Vortex-Velocity-Type Mass Flowmeter

The basic vortex-velocity-type meter is a volumetric measuring device (Fig. 3.). Gas flow is measured in cubic feet at flowing conditions. This flowmeter consists essentially of a section of tubing having a cylindrical chamber welded at right angles to one side. A vortex or whirlpool is generated in this chamber by the gas flowing through the tube. A rotor or vortex cage mounted in this chamber with its axis at right angles to the direction of flow revolves within the vortex.

The rotation of the vortex cage is proportional to the velocity of the gas flow. Volume rate is the product of rotor speed times an area factor. The volume is totalized on a counter connected through suitable gearing to the vortex cage.

The weight flow of gas can be determined by multiplying the volume flow in cubic feet at flowing conditions by the specific weight in pounds per cubic foot. Therefore, combining this meter with a specific weight measuring device results in a weight flowmeter.

The design of this density transducer, as it is called, differs somewhat from the unit previously described. A fan placed in the gas to be measured is driven at constant speed. The differential pressure created by the fan is fed into a pneumatic transmitter. The output of the transmitter is used to position a diaphragm which in turn positions a disk-ball-and-roller speed changer.

In effect the speed changer multiplies the metered volume by the specific weight. The result, totalized on a counter, is the cumulative gas flow in pounds.

Velocity-Change Mass Flowmeter

The principle of measurement of force required to produce a velocity change in a flowing fluid has been applied to produce what might be called a true mass meter (Fig. 4.). The meter basically is composed of two essentially identical elements. These elements are mounted independently in series upon an axis which is colinear with the pipe axis. Each element is composed of two thin-walled concentric cylinders with the annular space between the cylinders divided into narrow longitudinal passages.

Fluid flowing through the meter is directed through these passages in the two meter elements. The first element called the impeller is rotated at a constant speed. This imparts to the gas a constant angular component of velocity normal to the linear velocity of the flowing gas. This angular velocity component is removed from the gas stream by the second element called the turbine which is restrained from rotating. The force produced by the torque required to restrain the turbine from rotating is the meter output and is directly proportional to the weight flow rate.

The most interesting part of this meter is the device used to totalize the quantity of gas measured. The force produced by the torque from the turbine is applied to the gimbal ring of a gyroscope. This force, when applied to the minor axis of a specially designed gyroscope, will cause the gyroscope to precess around its major axis at a speed directly proportional to the thrust.

Since the thrust is proportional to the torque from the turbine, and the torque from the turbine is proportional to the weight-flow rate, the speed of precession of the gyroscope around its major axis is directly proportional to the weight-flow rate. Each increment of revolution of precession of the gyroscope is, therefore, directly proportional to the total weight of fluid which flowed through the meter while that increment of revolution was produced.

Through suitable gearing the precession of the gyroscope is applied to operate a counter. This records directly the cumulative total pounds of fluid flowing through the meter.

Field Calibration

These three measurement methods present problems quite different from those encountered with conventional volume flowmeters. Techniques of periodic field calibration are also different. It should be pointed out that the present so-called calibration performed on orifice meters is limited to a verification of the accuracy of the secondary measuring device, i.e., the static and differential pressure

recorder — and the thermometer.

Except for a physical inspection, the primary measuring element—the orifice plate and meter tube—is rarely questioned. This is so because of its wide acceptance. Proof of accuracy by an actual volume test is not demanded because of the confidence, built by experience, in conventional orifice measurement.

Confidence in the new types of weight flowmeters will not be so universal, at least for a long time. A great deal of field experience will have to be accumulated before these meters will be accepted without question. Periodic test and calibration procedures probably will be more complicated and more complete than those deemed necessary for conventional orifice measurement.

One question that is repeatedly asked is—Can a manufacturer produce his meters so that all are alike? Next—What about field replacement of meter parts? Obviously the answers to these questions can be gained only by extensive testing and experience. At present it appears that individual factory calibration will be necessary.

How to prove mass meters . . . The most reliable method of verifying the accuracy of a weight meter would be to actually weigh the gas passed through it over a short period of time. A laboratory test stand for doing just this has been built by one manufacturer. Field application of such elaborate proving equipment would be impracticable, however.

An acceptable alternate might be to periodically compare the field meter against a "master meter." The master meter could be installed in series with the field meter for the test. Proof of the accuracy of the master could be periodically determined at a laboratory weighing stand. Admittedly this procedure would be cumbersome where very large meters were used.

Calibration of the vortex-velocity-type meter, other than by use of a master meter, can be accomplished by using a critical flow prover—at least on the smaller sizes. The procedure is quite similar to the method used to prove conventional positive-displacement meters.

The specific weight-measuring instruments can be field checked with a pure gas such as nitrogen or methane. The pressure-volume-temperature relations of either of these gases are well known. Thus by operating the spinner or fan in a small portable pressure chamber filled with the test gas, the instrument output at a known specific weight could be determined. The instrument could be checked over its normal operating range by varing the pressure of the test gas.

Discussion

Drawbacks . . . There is one feature common to each of these types of meters that will, in some instances, be a drawback. That is the need for a 110-volt, 60-cycle power supply. This requirement may eventually be overcome with the development of a reliable constant-speed gas-driven turbine.

The simplicity of the orifice as a primary measuring device cannot be denied. Because of this and its present widespread use in gas measurement, the application of a specific weight recorder to obtain weight flow rate would be advantageous, especially on existing measurement stations. By changing orifice plate-bores, the rangeability of a single orifice-meter tube is considerably greater than that of the other two meter types.

On the other hand these two types of meters do not require lengthy meter runs for accurate response. Also, the total cumulative pounds of gas measured by them can be read directly without integration or computation. Thus their readings are readily telemetered for dispatching or even gas accounting.

Gradual application . . . The application of weight flowmeters will be gradual. Where only a few have been installed in a system, pounds of gas measured at one location must be balanced against volume measured at another. Fortunately it is not difficult to convert pounds to "standard" cubic feet. Thus it is possible to take advantage of the reduced calculations offered by weight meters even though volume measurement is required.

It will, however, be necessary to know the specific gravity of the gas being measured. The equation to convert the weight of gas to volume is simply

$$Q = w/G\gamma_a$$

where

- Q = volume, cu. ft. at base conditions.
- w = measured quantity of gas, lb.
- G = specific gravity of gas, dry air = 1.000.
- γ_a = specific weight of dry air at base pressure and temperature.

The specific weight of air, γ_a, will be a constant for any given pressure and temperature and may be determined from the relation

$$\gamma_a = 2.702 \frac{P_b}{T_b}$$

where

- P_b = base pressure, psia.
- T_b = base temperature, °R.

If desired, totalizing weight meters can be made to show a volume total. This is accomplished by adding a speed changer which is manually set to the flowing gravity.

References

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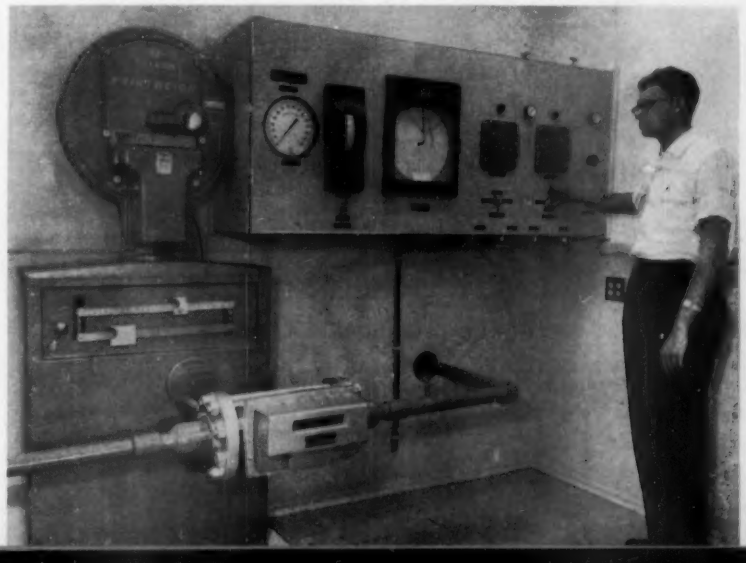
ASME Research Committee on Fluid Meters, "Fluid Meters, Their Theory and Application," Fifth Edition, 1959.

Howard S. Bean, "A Pound of Gas," December, 1954.

L. L. Laurence and H. E. Trekell, "Mass-Flow Metering," ASME Paper No. 58-PET-16.

Bruce J. Caldwell, "Evolution of the Vortex-velocity Gas Meter," Gas, April, 1959.

CALIBRATION RUN for velocity-change mass flowmeter. Shown are mass flowmeter, platform balance, and calibration and control instruments. Fig. 4.



New isomerization process claims

Octane improvement at 5-10 cents per octane-barrel . . . *depending on plant size, feed quality*

BY K. P. LANNEAU AND W. F. AREY
Esso Standard Oil Co.

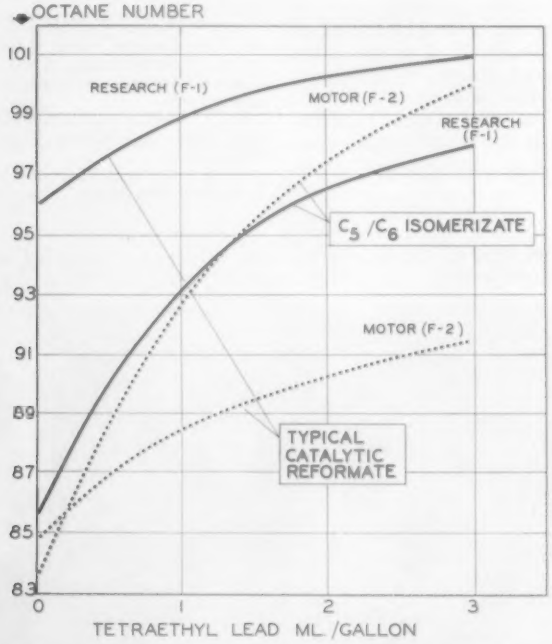
S. F. PERRY AND A. SCHRIESHEIM
Esso Research & Engineering Co.

AND H. A. HOLCOMB
Humble Oil & Refining Co.

AN ISOMERIZATION PROCESS for upgrading C_5/C_6 virgin naphthas is being developed by Esso Research & Engineering Co. The process employs a highly active catalyst which permits liquid phase operation at low temperature, 80°-120° F. Equilibrium isomer distribution at this temperature level favors formation of the branched, high-octane isomers. The process operates with almost 100 vol. % yield at high conversion levels, and high-octane isomerizate is produced without product fractionation and recycle of low-octane isomers. Since product octane is limited by equilibrium considerations, all light virgin naphtha feeds are upgraded to about the same level. Arabian and Louisiana C_5/C_6 feeds of 84.0 and 89.5 research (+ 3 ml. TEL gal.) octane numbers, respectively, are converted to isomerizate of approximately 98 research (+ 3 ml. TEL) octane. The product from the Esso low-temperature isomerization process shows excellent blending characteristics in high-octane motor-gasoline pools. Its high-octane ratings and inherent volatility make the isomerized C_5/C_6 naphtha a desirable blending component for premium-grade gasolines. Economic studies show that total costs of octane improvement by the new process are in the range of 5 to 10 cents per octane barrel.

Why Isomerization Is Attractive

In theory, there are three ways to improve the octane rating of light virgin naphtha—by isomerization, by dehydrogenation to olefins, and by aromatization. Aromatization, of course, is restricted to C_6 or heavier. The C_5 and C_6 isoparaffins, produced by isomerization, have high octane numbers by both the ASTM research and motor methods, and excellent lead response.



COMPARING C_5/C_6 isomerizate with catalytic reformate on ASTM octane ratings. (Isomerizate from Louisiana virgin C_5/C_6). **Fig. 1.**

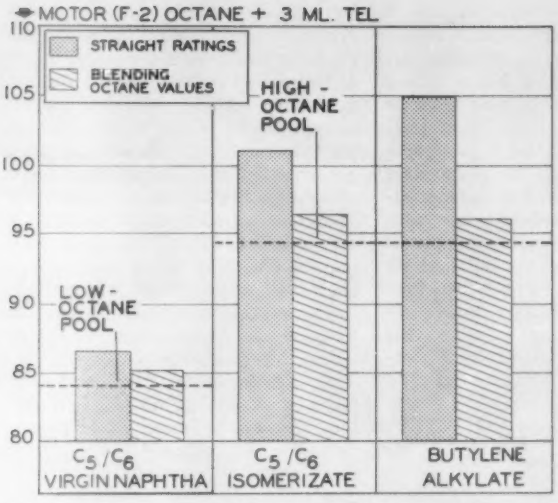
Presented at Fifth World Petroleum Congress, New York.

Importance of Reaction Temperature

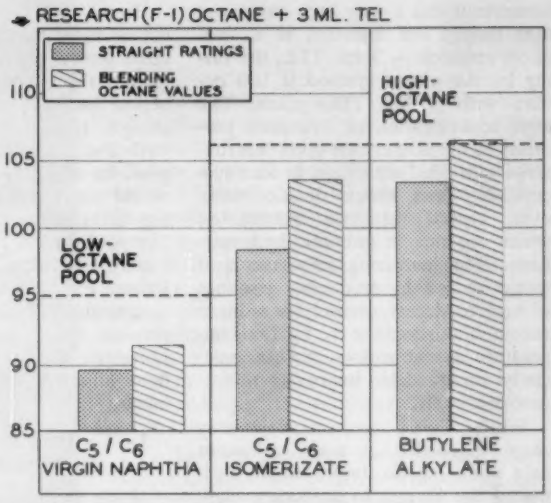
The attractiveness of a C_5/C_6 isomerization process is critically dependent upon obtaining high conversion to the most branched isomers. High conversion means high octane improvement per pass and the reduction or elimination of costly product recycle. Conversion in isomerization is limited by the thermodynamic equilibrium, which is much more favorable for branched paraffins at lower temperatures. This is particularly true with respect to the concentration of 2,2-dimethyl butane in the C_6 paraffins.

The high-temperature level for C_5/C_6 isomerization, 700°-900° F., is the approximate range of several recently developed "Hydroisomerization" vapor-phase processes which use supported precious-metal catalysts. The 200°-250° F. temperature range is typical of the so-called $AlCl_3$-sludge process, in which a C_5/C_6 feed is isomerized in the liquid phase in the presence of an $Al\text{-}Cl_3$-hydrocarbon complex as the catalyst. The 80°-120° F. temperature range for isomerization is representative of the new Esso low-temperature process described here.

The Esso low-temperature process has a potential advantage in once-through product octane, over the hydroisomerization type processes, of more than five octanes in the C_5 paraffins and nine octanes in the C_6 paraffins. On the other hand, equilib-



RESEARCH (F-1) OCTANE BLENDING characteristics of light virgin naphtha, isomerizate, and alkylate. Virgin naphtha and isomerizate are feed and product from isomerizing Louisiana C_5/C_6. **Fig. 2.**



MOTOR (F-2) OCTANE BLENDING characteristics of light virgin naphtha, isomerizate, and alkylate. Virgin naphtha and isomerizate are feed and product from isomerizing Louisiana C_5/C_6. **Fig. 3.**

rium C_6 naphthenes have higher octane at the higher temperature. However, since typical refinery C_6 fractions contain no more than 10-20 vol. % naphthenes, the effect of paraffins predominates. In pentane isomerization, recycle of unconverted normal-pentane is feasible by fractionation of the product. Higher conversion per pass through the reaction zone does, however, reduce the cost of octane improvement of the pentane fraction. In the case of C_6 fractions the boiling points of some of the paraffin isomers are very close to each other. The attendant high cost of superfractionation required to separate the low-octane isomers militates against product recycle in hexane isomerization. The increasing need for an economical process to upgrade the C_5 and C_6 fractions of light virgin naphtha indicates the desirability of a truly high-conversion isomerization process. The new process discussed here gives high conversions to isoparaffins and makes it possible to upgrade C_5/C_6 feeds to attractive octane levels without product separation and recycle.

Pilot-Plant Results

Extensive pilot-plant studies have been conducted during development of the process. In typical operations a combined C_5/C_6 naphtha feed is first pretreated to remove impurities which might result in poor operability or excessive catalyst consumption. The feed is then isomerized in the liquid phase at the very low temperature of 80°-120° F., made possible by the use of an extremely active catalyst.

Typical feed and product data from pilot-plant operations isomerizing the virgin Louisiana C_5/C_6 feed are presented in detail in Table 1. This feed is a good-quality light virgin naphtha, having a relatively high research (+ 3 ml. TEL) octane rating of 89.5. Even so, isomerization of this feed upgraded it approximately 8.5 octane numbers to a 98.0 level.

Table 2 shows similar data for isomerizing the C_5/C_6 fraction from an Arabian crude. This feed contains less benzene and naphthenes and substantially more normal-pentane and normal-hexane than the Louisiana C_5/C_6. Thus, it is a lower-octane feed. Since isomerizate octane number is limited by equilibrium considerations, the product from the Arabian feed has an octane number about equivalent to the product from the higher-quality Louisiana feed. Therefore, the low-temperature once-through isomerization process upgrades the Arabian feed by a very substantial 14.5 research octane numbers.

TABLE 1—LOUISIANA C_5/C_6 FEED AND PRODUCT COMPOSITION, VAPOR PRESSURE, AND OCTANE RATINGS

Component	Feed Vol. %	Product* Vol. %
Normal pentane	16.3	4.8
Isopentane	11.6	23.1
Normal hexane	19.0	4.4
2,2-dimethyl butane	1.9	20.7
2,3-dimethyl butane	2.1	5.0
2-methyl pentane	15.3	11.4
3-methyl pentane	9.4	6.2
Cyclopentane	2.3	1.8
Methylcyclopentane	10.9	2.2
Cyclohexane	6.4	15.6
Benzene	4.8	4.8
Normalized Total	100.0	100.0
Reid vapor pressure, psig.	9.2	11.1
ASTM octane ratings		
Research (F-1) + 3 ml. TEL	89.5	98.0
Motor (F-2) + 3 ml. TEL	86.6	101.0

* Converted once-through at 80-120° F. C_5/C_6 yield is greater than 99 vol. %.

TABLE 2—ARABIAN C_5/C_6 FEED AND PRODUCT COMPOSITION, VAPOR PRESSURE, AND OCTANE RATINGS

Components	Feed Vol. %	Product* Vol. %
Normal pentane	29.1	7.1
Isopentane	11.3	33.3
Normal hexane	30.4	4.1
2,2-dimethyl butane	0.0	25.2
2,3-dimethyl butane	0.7	4.6
2-methyl pentane	11.3	12.0
3-methyl pentane	8.6	5.1
Cyclopentane	0.7	0.1
Methylcyclopentane	5.4	0.9
Cyclohexane	1.5	6.6
Benzene	1.0	1.0
Normalized totals	100.0	100.0
Reid vapor pressure, psig.	10.0	12.6
Octane Ratings		
Research (F-1) + 3 ml. TEL	84.0	98.5
Motor (F-2) + 3 ml. TEL	83.0	101.5

* Converted once-through at 80°-120° F. C_5/C_6 yield is greater than 99 vol. %.

C_5/C_6 Isomerizate as a Motor Gasoline Component

The data in Tables 1 and 2 show that high-conversion isomerization by the Esso low-temperature process can upgrade C_5/C_6 virgin naphthas to a research octane level approximately equivalent to that of other major components in motor-gasoline pools. Fig. 1 points up further the excellent quality of the C_5/C_6 isomerizate. The

isomerizate has a very high motor octane rating. For instance, at a level of 98 research + 3 ml. TEL, the rating by the motor method is 100 octane with 3 ml. TEL/gallon. The high concentration of branched paraffins in the isomerizate gives this material a decided advantage in lead susceptibility and motor octane rating over typical catalytic reformates, which are rich in aromatic hydrocarbons. The increasing importance of motor octane in producing gasolines of high road performance for modern automobiles should make the low-temperature isomerization process especially attractive for improving motor-gasoline pools.

While C_5/C_6 isomerization may soon be needed in many refineries as a pool-octane-improvement step, use of the process to produce a high-octane blending component is especially interesting. Even in cases where a refiner can manufacture enough octanes to meet pool requirements, it may be very difficult to separate the high-octane streams required to produce a premium-grade gasoline seven to nine octane numbers higher than the regular grade. Volatility specifications may also pose a problem in high-octane gasoline blending. Thus, high-octane ratings and inherent volatility of C_5/C_6 isomerizate make it an excellent blending component for premium gasoline production.

Fig. 2 shows the research octane blending characteristics of low-temperature C_5/C_6 isomerizate when it is blended into a very high-octane pool rich in aromatics. This is a typical future pool for premium gasoline. While the straight rating on the isomerizate is 98 octane on a research basis, it blends into the pool as if it had a 103-104 research rating. This is referred to as the blending octane value. (Octane blending values in Figs. 2 and 3 were determined on blends containing 25 vol. % of the component and 75% of the pool indicated.) The isomerizate blends at a value near the level of the high-octane pool. It is only slightly inferior to a butylene alkylate in this respect.

The C_5/C_6 virgin naphtha, from which the isomerizate was produced, is too low in octane to be considered for blending into future premium gasolines. Therefore, its blending value in a lower-octane pool for future regular-grade gasoline is given in Fig. 2. The difference between the blending octane values shown for the virgin naphtha and the isomerizate is 11-12 numbers, and this represents the amount by which the isomerization process upgrades the Louisiana C_5/C_6 fraction as a gasoline-blending component.

Fig. 3 shows the important motor octane blending characteristics of the same isomerized C_5/C_6 naphtha. Although the isomerizate has a motor octane blending value lower than its straight rating, it blends at a level well above that of the high octane pool. In other words, the isomerizate would improve the motor octane rating of the future premium-grade gasoline pool. In this respect it is approximately equivalent to the butylene alkylate. Fig. 3 also shows that low-temperature isomerization would appreciate the blending value of the Louisiana C_5/C_6 naphtha by 11 octane numbers on a motor-method basis.

C_5/C_6 Isomerizate for Aviation Gasoline

While the major need for isomerization is to upgrade light virgin naphtha in motor-gasoline pools, C_5/C_6 isomerizate is a potential aviation-gasoline blending component. Table 3 shows the aviation antiknock ratings of a low-temperature isomerizate compared to ratings of a high-grade alkylate and a light virgin naphtha, which are typically the best and poorest components, respectively, in aviation pools. The relatively high lean and rich ratings of the C_5/C_6 isomerizate would make it possible to back out some of the light virgin naphtha base and to blend some of this better component into aviation gasoline, thus reducing the requirement for high-octane alkylate. This would have the effect of extending the supply of aviation gasoline, or of making more high-octane alkylate available for use in premium-grade motor gasolines. Blending studies have shown that up to 20 vol. % of low-temperature C_5/C_6 isomerizate can be included in an aviation pool to produce a high-grade 115/145 (lean-rich) aviation gasoline of required volatility and vapor pressure.

Process Economics

Estimates of the process investment and direct operating costs for low-temperature C_5/C_6 isomerization plants of two sizes are given in Table 4. These costs include feed preparation to remove certain impurities, present in most feeds, which might result in poor operability or excessive catalyst consumption. It is assumed that a feed of suitable boiling range is available. Therefore, no feed fractionation costs are included. Direct operating costs include operating labor, catalyst and chemicals, utilities and maintenance.

The process investments shown in Table 4 are approximate values and would, of course, vary considerably with engineering standards and location. It should be noted again that the Esso low-temperature process makes a high-octane product with once-through isomerization. This eliminates the high investment and operating costs of superfractionation for product recycle required in higher temperature processes to reach a comparable octane level.

TABLE 3

C_5/C_6 Isomerizate Compared to Other Aviation-Gasoline Blending Components*

	Aviation antiknock ratings*	
	Lean (ASTM-D614)	Supercharge Rich (ASTM-D909)
Component—		
C_5/C_6 isomerizate	109	129
Alkylate	130	163
Light virgin naphtha	90	97

*Ratings of 4.6 ml. TEL/U.S. gallon. Numbers above 100 are performance numbers, below 100 are octane numbers.

TABLE 4

Economics for Esso Low-Temperature Isomerization Process

Plant size, BPCD	5,000	17,000
Process investment, $/BPCD	400	250
Direct operating costs, cents/bbl.	35	30

Unit costs for octane improvement (cents per octane barrel) are affected by such factors as plant size and feed quality. Since product octane number is limited by equilibrium at the temperature employed, lower unit costs for a given processing cost can be obtained with low-octane feed stocks, such as the Arabian C_5/C_6. It has been assumed that a total of C_5/C_6 virgin naphtha is fed to the isomerization process. The addition of a feed deisopentanizer would permit some further octane improvement and add flexibility for gasoline blending. This might or might not lower unit cost of octane improvement, depending upon isopentane content of the feed. In some refineries feed stocks of very high normal paraffin content are available as a result of superfractionation and/or extraction operations. This provides particularly favorable circumstances for economical octane improvement by isomerization.

It is estimated that total costs of octane improvement by the Esso low-temperature process are generally in the range of 5 to 10 cents per octane barrel, depending upon plant size and feed quality. This includes direct costs, normal overhead charges for an average refinery, and 3-year amortization of the plant. This low cost for motor-gasoline octane improvement is very attractive to refiners at present and projected octane levels.

"... The chemical industry in the next decade will be characterized by the greatest competition the industry has ever known ... It will be quite different from the past 10 years when there was a wild rush to build new plants—sometimes without enough regard for costs.

"... The engineer's task will not be easy ... It is alarming—but on second thought, stimulating—to realize that the design of many of our present operating plants was based on inadequate knowledge ... One of the pluses in the trend toward automation is that it has forced us ... to fill in the voids of our basic understanding of the reactions with which we are dealing.

"... In some processes using expensive raw materials, costs are influenced more by improvement of yield than reduction in labor. Likewise, there are processes where capital charges far exceed labor charges. Therefore, automation must enable us to make major advances in design or operation which will reduce capital costs as well as operating costs ..."

Dr. C. A. Thomas
President,
Monsanto Chemical Co.

During the next decade, chemical plants such as this one at Texas City may advance rapidly in . . .

Systems engineering

BY THEODORE J. WILLIAMS
Monsanto Chemical Co.,
St. Louis

The author predicts that the next 10 years will see solution of most of the problems in use of systems engineering and computer application. The industry will then be engaged in what may be termed "economic automation"—i.e., as much instrumentation and automatic control (including computer control) as can be economically justified, not automation just for the glamor of it.

THERE WILL BE a continued and rapidly expanding exploitation of systems engineering and computer applications in the process industries. What will be its extent in the next 10 years or so?

In answering this question, the past is of little or no help. Digital computers were confined to a very few government and university installations in early 1949 and the modern analog computer had just been invented.

Truly tremendous strides have been made in the past 10 years. Most of this advance is due, of course, to the defense effort. But the process industries can and will capitalize on this progress as rapidly as the necessary trained personnel become available.

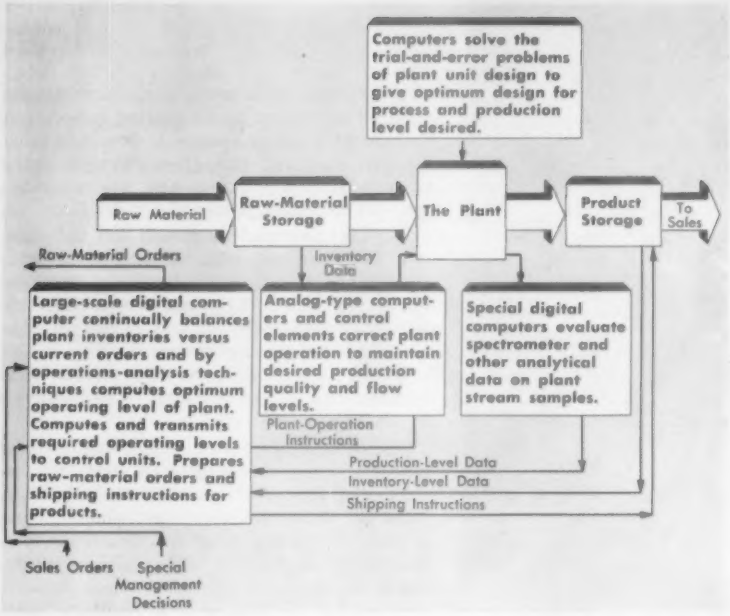
What about personnel availability? . . . This seems to be the greatest bottleneck to an even more rapid progress. Much rests on the availability of highly trained personnel needed to carry out advanced studies and operate the machines involved.

Persons in management and plant operations who know and appreciate the power of these methods and devices will demand their use for study of their own particular plants and processes.

How many companies? . . . We expect a minimum of up to 75 of the 100 largest companies to have groups studying process control and process dynamics within the 10-year period. It seems an absolute necessity that each of them will have access to analog-computing equipment to carry out studies.

This is imminent, unless a revolution occurs in digital-computer speed and flexibility within this same time period, to increase calculation speeds by about two orders of magnitude over present machines. In that case, digital-computer systems would be used for process simulations.

How many computers? . . . Every important chemical and petroleum company will have large-scale digital-computing equipment—not just one installation but probably several in the larger companies. If instrumentation developments keep pace, we can


Computers solve the trial-and-error problems of plant unit design to give optimum design for process and production level desired.
Raw Material
Raw-Material Storage
The Plant
Product Storage
To Sales
Raw-Material Orders
Inventory Data
Large-scale digital computer continually balances plant inventories versus current orders and by operations-analysis techniques computes optimum operating level of plant. Computes and transmits required operating levels to control units. Prepares raw-material orders and shipping instructions for products.
Analog-type computers and control elements correct plant operation to maintain desired production quality and flow levels.
Special digital computers evaluate spectrometer and other analytical data on plant stream samples.
Plant-Operation Instructions
Production-Level Data
Inventory-Level Data
Shipping Instructions
Sales Orders
Special Management Decisions

DIGITAL PLUS ANALOG CONTROL is a possible form of computer control for a chemical processing plant. The idea is to control automatically individual units by conventional analog elements, with monitoring of pertinent plant streams by stream analyzers. Then a central digital computer is used to maintain a continuous optimization program. Fig. 1.

see the possibility of up to 150 large-scale computers being used throughout the processing industry for repeated plant-optimization studies alone. We expect in 10 years to see several of these permanently connected into plant operations in a manner similar to the scheme of Fig. 1.

Any other bottlenecks? . . . A second important bottleneck might be lack of required plant instrumentation, particularly stream-composition analyzers. However, progress has been made in the past few years in development of refractometers, spectrometers, and chromatographic analyzers. This progress should continue.

Systems Engineering?

There are many definitions of systems engineering, depending on who is doing the defining. Our definition is an intermediate one, involving combination of four concepts; we view systems engineering as:

1. An attempt on the part of the process engineer to consider all aspects of the design of a processing plant as a whole unit—the chemical kinetics, the heat and mass transfer, and the process dynamics as well as the instrumentation and automatic control.

2. A recognition that both analog and digital computers and advanced mathematical techniques will usually be necessary to evaluate properly and describe the numerous and complex relationship involved.

3. An implication that management recognizes that more time and many more basic data will be necessary for such an approach than has been necessary in the development of many processes in the past.

4. An application of advanced automatic-control concepts which can be economically justified for a given plant.

Optimizing Unsteady-State Operation

Conventional process-engineering practices have always sought to optimize the operation of processes while in the "steady state" or smooth operation. It is only in systems engineering that we have had the tools to quantitatively optimize unsteady-state operation. This is done by (1) minimizing the magnitude and duration of any upsets, and by (2) shortening and simplifying startup operations. Thus it should be possible to operate chemical processing equipment at even higher over-all average throughputs and with higher quality products and higher yields and lower capital investments than at present.

Systems engineering is tied to the use of automatic computing equipment, both analog and digital. It is also the opinion of many of us that the converse of this last statement is likewise true. That is, the application of large-scale computers to processing problems gives the best results when coordinated with an over-all systems program whether it actually bears that specific title or not.

Some Pitfalls

At the moment, only a very few pioneering processing companies are actively pursuing a program in systems engineering on their own. The present push in this direction is coming largely from some of the systems-engineering and electronics companies who are heavily engaged in national defense work and wish to expand their sphere of activities, and from the digital-computer manufacturers who see process control as another potential field of application for their products.

This can be both good and bad. It does provide the push to get many companies participating who might not otherwise do so or who might have delayed their entry for several years. But it finds the process industries ill-equipped and without enough properly trained personnel to adequately advise their new associates as to the places and means to apply computer control for its best effect.

Likewise, most of the staffs of the manufacturers of these computers are not equipped to make the optimum decisions on their own because they cannot be presented with the complete technical and economic picture as seen from the process industries' viewpoint.

Thus, the possibility exists of our making installations of these expensive devices which might be ultimately harmful to the systems-engineering concept in the long run. This could be because the computer was overtaxed as a control element and became essentially an expensive data logger. Conversely, it might be required to carry out duties which could be just as easily handled by much simpler and cheaper standard controllers with cascade loops.

Ultimate Goal

Two trends are shaping up as requirements for future plants:

- First, they must be designed much more exactly than in the past to keep initial capital costs as low as possible and to help prevent the extremely expensive startup redesigns and modifications which are all too common today.
- Second, whenever possible, they should be designed to produce any one of a wide variety of similar products through modification of the operating cycles of the plant or changes in the operating levels and conditions as the sales picture varies.

Digital-computer application groups are at present hard at work devising routines for the exact design of process plant units to supersede the rules-

of-thumb and the approximation formulas so common and so necessary at present when hand-design methods are required. Examples of some of those showing the greatest success at present are the distillation-column design studies of Greenstadt[3] and the cooler-condenser design methods devised at Monsanto.[5] All require medium or large-scale digital-computing equipment because of their extremely complex nature and because trial-and-error methods of solution are invariably required.

The second trend listed will be made a practicality through the kinetic studies and computer simulation also mentioned before. Various reactor configurations can be used in the simulations, to determine which will give the optimum results over the span of products desired, as well as the required changes in operating conditions necessary to achieve these results.

Optimization of Operating Procedures

Greater knowledge of the kinetic behavior of our reaction systems can result in better plant designs. This knowledge also can lead to continued savings during the full life of the plant. As catalyst activity shifts, as raw-material quality and costs and utility costs vary, and as sale prices fluctuate, the optimum production levels and operating procedures worked out during the plant-design phase may no longer be applicable. However, a rerun of the simulation with the new costs, etc., supplied will quickly establish the new optimum conditions.

In fact, a complete knowledge of the kinetic behavior of the process is often not necessary to derive essentially the same results. Many times a statistical analysis of the available operating data on an established unit will yield enough information to permit these optimization studies of operating conditions to be made. But kinetic knowledge obviously is desirable, whenever it can be obtained, because of the greater detail and accuracy possible in the resulting optimization.

Plant Operation and Plant Control

The next step beyond regular optimization of plant operation by means of computer studies is, of course, that of actual plant control by the computer itself.

As noted, there is at present a major push to apply digital computers to chemical-plant and petroleum-refinery control. Undoubtedly they have many potential and worthwhile applications. However, there are several basic considerations which must be kept in mind when considering them. These are:

1. In most cases, an over-all digital-computer installation would be more expensive than the corresponding regular control system as now applied.

2. Current research is showing that, in the absence of such things as rapidly deteriorating catalysts and with adequate detecting instruments, properly designed and used conventional control systems can give perfectly satisfactory control of plant units.

3. Conventional control systems do not at present have the facility to carry out optimization studies of the operation of a plant unit and cannot have in the foreseeable future. However, such optimizations need be carried out only at extended intervals or when major changes occur in plant operation conditions or requirements.

4. A digital control system must, of course, pay out its increased costs by providing returns in the form of higher product purity, increased production, or a combination of these.

● Research in process dynamics and control is usually necessary before installing such systems. Therefore, the return from the digital system should be compared with the conventional system having the advantage of the same new knowledge.

● Thus, the comparison of a digital-control system for a distillation column which uses stream-composition analyzers with a conventional control system sampling only tray temperatures would not give an adequate evaluation of the true worth of the digital computer. Much of the resulting gain could be assigned to the stream analyzers and not necessarily to the computer. Unfortunately, much of the present-day justification of computers for process control is on just such a basis.

Digital Plus Analog

It would thus seem desirable to develop a system which combined the best advantages of both the digital and the conventional analog-type control systems since this should be the combination which can give the maximum capability at the lowest possible cost. The author[8] has previously proposed a system for ultimate plant control which should give this combination of the best features of both conventional control systems and the newer computers (Fig. 1).

Individual units on analog-computer control . . . Under such an arrangement, each small unit of the plant would be individually—but automatically—controlled at some certain operating level by conventional analog-type elements. All pertinent plant streams would be monitored by stream analyzers which would be cascaded to these unit controllers to maintain the operating levels previously established.

Central digital-computer control . . . Results of the analyzers as well as the flow rates of all streams would be sent to a centrally located medium or large-scale digital computer which would be used to maintain a running inventory of the various plant units and of raw material and product storage. It would also maintain a running account of orders for plant products as they are received.

Then, by a continuous optimization program, the computer can determine the optimum operating level for each of the various plant units to keep them in coordination and match the current sales volume. It would then transmit the required data to the individual analog elements to change their set points to match the new operating conditions. Likewise, optimum raw-material inventories consistent with the current sales and production schedules could be determined by the computer and the necessary sales orders placed automatically as needed.

The "Automatic" Company

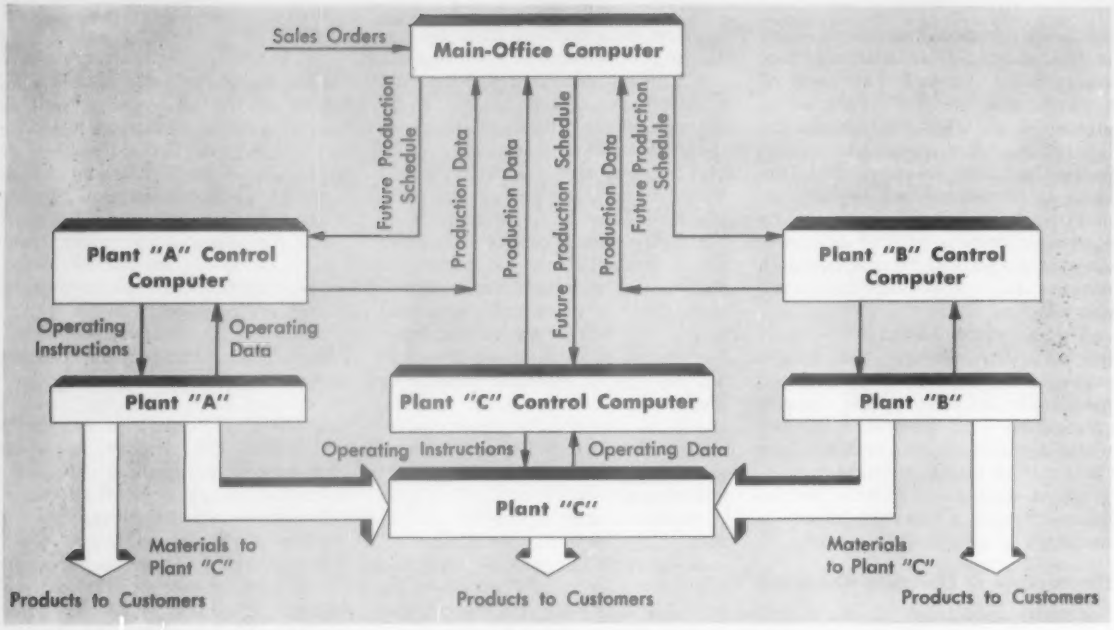
Fig. 2 carries this analysis one step further by considering a central office computer which can monitor the results shown by the several plant-control computers, optimize the production picture for the whole company, and control the operation of the individual plant computers accordingly.

Digitals control indirectly . . . Notice that in these examples the large digital computers do not control the plant directly. This is done by smaller, less capable units. They do, however, direct the level of production by adjusting the point at which the smaller units control the plant.

Thus, true use is made of the ability of the modern digital computer to consider the masses of data and make the thousands of algebraic computations necessary to decide which of several alternate proposals satisfies the optimization criteria imposed, whether it be lowest unit cost, maximum production, etc. On the other hand, true use is also made of the major ability of conventional analog-control elements, which is to continuously monitor an output variable of the process and continuously adjust an input element to maintain the output at the preselected level.

Process Engineering Sciences

Many of our present process plants were designed with only partial knowledge of the reactions involved and on



THE "AUTOMATIC" COMPANY SCHEME goes a step further. It contemplates use of a central office computer to monitor results from several plant control computers, optimize the production picture for the whole company, and control operation of the individual plant computers accordingly. Fig. 2.

the basis of approximation formulas for such things as heat and mass transfer coefficients. Therefore, the use of very large safety factors was necessary to be sure that a particular plant unit would adequately carry out its assigned task. This then has resulted in excess capital costs.

Less Art and More Science

We now need to obtain much more exact expressions for the operating parameters of a processing plant, such as for the heat and mass transfer relationships, to allow the proper sizing of the required pieces of apparatus. In addition, and perhaps even more important, we must find out as much as possible about the chemical reactions we are undertaking. Particularly, one must establish the effect of operating conditions such as temperature and pressure on reaction rates and on byproduct types and amounts.

A new engineering . . . Fortunately the techniques and devices necessary are already available today. They are contained in what is really a new applied chemical-engineering sciences program but which also can be defined by the same four points which we have already used to define systems engineering. In fact, their combination has actually been described as systems engineering by some writers.[2] Under these we include—in addition to the process dynamics, process control, and analog computer operation usually considered to be systems engineering in the narrow sense—large-scale digital computers and their use through applied mathematics for chemical-engineering problems of all degrees of complexity. And finally we include the recent effort to re-explore the fundamentals of heat and mass transfer, fluid flow, and the other unit operations which are generally collected under the title "engineering research."

"A rose by any other name" . . . Some of my associates may disagree with my inclusion of their special activities under "systems engineering." What the result is called, whether "systems engineering" or not, is really immaterial. It is the fact of coordination of effort that counts.

New Methods

This application of analog and digital computers along with the recent findings in engineering and chemical research has already made obsolete many of the previous methods and practices.

1. Perhaps the most striking change has come in chemical-reaction kinetics. Older methods required the development of over-all orders of reaction and over-all rate constants. The newer methods (along with use of computers) permit the specification of each of the reaction steps and their individual rate constants. The resulting systems of equations are very large and the determination of the many reaction constants is difficult, but computing machines make such work now practicable.

2. Methods are now being derived which promise to determine the physical properties of gaseous and liquid systems from readily made measurements of only a few of the physical parameters of the components of the system.[4] (A summary of this approach was given in The Oil and Gas Journal, February 13, 1956, p. 113.) Such methods will be of immeasurable aid to plant design studies when finally perfected.

3. Current experimental research along with the application of servomechanism techniques is rapidly establishing the dynamic behavior of process equipment when under transient conditions as when subject to upsets and during startup.

Process Research in the Future

At present, the chemist works out the probable yields and over-all best reaction schemes and reaction conditions by means of a multitude of laboratory reactions.

In the future, the recommended procedure will be for the chemist to carry out a select few very highly instrumented runs for which complete chemical analysis versus time are obtained. The resulting data will be reduced on computers to derive the most complete kinetic-reaction mechanism possible and to obtain the per-

tinent reaction constants as functions of temperature and other variables. Necessary solubility products for gas-liquid systems, etc., will also be obtained by such methods.

The bugaboo of scaleup . . . Derivation of the complete reaction model then opens the way for a detailed computer simulation of the process to determine the effect of all process parameters on yields and by-product formation. This permits the truly optimum processing conditions to be specified long before any final plant design or plant tests are made. Also, inclusion of reactor and other plant-unit dynamics along with heat and mass transfer relationships in the computer simulation can set at rest once and for all the bugaboo of scaleup which has been such a headache for our plant designers for so long.

Where existing theories and data do not completely specify the physical parameters of the reaction system such as viscosities, etc., these can be determined by special small bench-scale tests as needed.

No more pilot plant? . . . The reader can probably guess the next point. This is that such investigations will then allow us to eliminate the expense and time of the use of the pilot plant as a scaleup device. True, it will still be valuable for pilot production of the product for market development, etc., but its use as an intermediate step in building the producing plant would no longer be necessary.

Before the reader becomes too skeptical, I would hasten to add that the above statements are not pipe dreams or blue-sky predictions. This procedure is already actually being carried out at least in a preliminary way. Its full use awaits only the acquisition of enough properly trained systems personnel and the necessary computing equipment to bring it to full use.

The Personnel Problem

In a recent report[7], the educational subcommittee for process control of the AICE surveyed, via questionnaire, the present status of personnel assigned to process-control activities in the chemical and petroleum industries, and from this attempted to predict future trends. Note that the subcommittee was interested in process-control specifically. Therefore, the answers received to their questions concern this aspect of systems engineering alone and not the over-all general view of future process development and plant design and operation.

How many systems-engineering specialists? . . . By means of several assumptions which may be developed from the results of the AIChE questionnaire, a probably minimum level of use of systems-trained personnel can be developed. They are:

1. Formal systems-engineering work will be confined to the larger companies, probably among the top one hundred.
2. It would appear that at least one-half, and possibly three-fourths, of these companies will eventually have such an organization.
3. An average-sized systems group would comprise at least 10 engineers.
4. Each company will need at least twice as many systems-trained personnel outside the group. This outside group might run to 20 men per company and include liaison personnel, instrumentation and control engineers, and advisors on data collection and reduction and problem development.

A calculation based on these assumptions indicates that at a very minimum between 1,500 and 2,250 engineers will eventually be engaged in systems-engineering type work by the chemical and petroleum industries in the next 5 to 10 years. These personnel should all have advanced degrees and be trained in automatic-control principles and the use of computers as well as having a thorough background in the field of process engineering.

Again the reader is cautioned to recall that the above discussion refers to systems-engineering personnel engaged specifically in process dynamics and process-control work. This is not intended in any way to include personnel in the associated work with digital computers, applied mathematics, engineering research or related functions. If these were to be included, the totals would approximately double. However, detailed survey information is not available to verify this latter statement.

Process-control course . . . In addition, the education subcommittee recommended that all chemical-engineering graduates be exposed to a course in process control during their undergraduate training which will let each of them appreciate the true place of automatic process control, electronic computers, and mathematical analysis as tools in process development, plant design, and plant operation. A systems-engineering group which does not have adequate field backup will have great difficulty achieving the expected results.

Training of systems engineers . . . The process industries will necessarily train some of their present personnel for systems-engineering work. But the vast majority must come from our universities.

What is an interim measure? . . . Personnel with training of the type necessary to carry out systems-engineering investigations are at present quite rare among process engineers. On the other hand, many electronic engineers have a good background in general control-system theory and in analog-computer operation. But these latter lack a detailed knowledge of the types of problems which arise in process development, dynamics, and automatic control.

As an interim measure, it seems desirable to carry out each project by a team of two engineers, one processing and one electronic. Such an arrangement has been used at Monsanto for the past year and a half and has already achieved exceptional results. While these engineers had some difficulty in the very beginning developing a common nomenclature, it was soon found that mathematics is a common language between all engineering disciplines. This arrangement has also proven itself to be an extremely good training system for both types of engineers. However, as more process engineers acquire the necessary training, the need for such a team effort becomes progressively less.

Because of the mathematical background necessary for all engineers engaged in this work, the masters degree or its equivalent or an even higher level of training is required.

Taken from Texas A & M Process instrumentation symposium, 1959.

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The

FOREMAN'S PAGE

PART 3—SAFETY AND BLOWDOWN FACILITIES

Here's how one refinery handles

Safety valves and their maintenance

IT IS NECESSARY in various operations carried out in the Baton Rouge refinery to provide some means of insurance against overpressuring and, in some cases, underpressuring the equipment. This protection is intended to take care of mechanical failures or operational errors which might otherwise create emergency conditions on the unit.

Such protection is afforded through the use of "safety" or relief valves. The Baton Rouge refinery has between 5,000 and 6,000 safety valves installed in numerous locations for varying service conditions. These safety valves range in size from ½ to 24 in., cover all pressure ranges from full vacuum to 15,000 psi. (on an experimental unit), and are installed on equipment handling many types of chemicals and a wide range of different hydrocarbons.

Shell-and-tube exchangers may be protected by safety valves if they can be subjected to higher than design pressure in operation and in cases where block valves can be closed to subject liquid to thermal expansion. It has been found, however, that the installation of small safety valves on shell-and-tube equipment for protection against thermal expansion is not as reliable as depending on correct operating procedures by the operating personnel.

Safety valves may be required on the discharge ends of pumps to protect casing, lines, fittings, etc., that may not be designed to withstand the shutoff pressure of the pump. Nearly all storage drums, reflux drums, towers, and the like must be protected.

The safety valve should be located as near to the source of pressure as possible. In some cases pressure can originate at more than one place and it is then advisable to have two small valves, one at each point. Where a plant normally operates for a longer period of time than is customary to allow between safety-valve inspections, dual safety valves may be installed to permit valve inspection without shutdown, or in some cases spare safety valves may be provided which can be installed quickly.

Types of Safety Valves

The four principal types of safety valves used at Baton Rouge are deadweight, spring-loaded, vacuum and frangible disks.

In the deadweight safety valve, generally a bevel-seated disk is equipped with a stem to which are added weights. The internal pressure of the equipment being protected acts on the under side of the disk, and when the pressure becomes great enough the force exerted on the disk becomes equivalent to the total weight of the disk, stem, and weights. Any additional pressure will raise the disk. The pressure will thereby be released and the safety valve will remain open until the weights overcome the force exerted by the internal pressure, and the valve will then close.

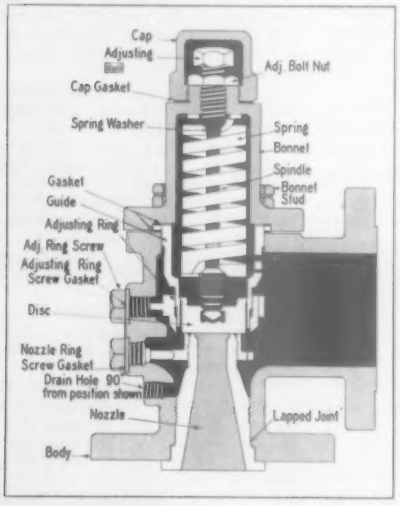
The operation of the spring-loaded safety valve employs the same basic principles as the deadweight valve except that in this case the counterload is imposed by a spring. The set pressure can be altered by changing the load imposed by the spring. This can be done by changing the length of the spring or by the installation of a heavier or lighter spring.

When the internal pressure exerts enough force on the bottom of the disk to overcome the weight of the disk and spindle and the spring load, the valve will open and will remain open until the load conditions are reversed and the spring load exceeds the force exerted by the internal pressures. The valve will then close, and in most cases will reseat itself.

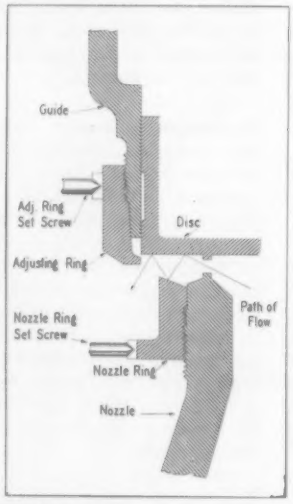
There are two types of spring-loaded safety valves which differ slightly in construction. Valves intended for liquid service differ from those intended for vapor service only in that a ring is provided around the safety-valve nozzle in the vapor valves. This causes a reversal of flow of the discharging vapors, thereby creating a turbine action which results in an applied force on the under side of the disk, and this applied force assists the internal pressure in keeping the valve open. This nozzle ring is adjustable so that the applied turbine force can be varied.

In safety valves of this type, the valve will not close and reseat until an internal pressure somewhat less than the set pressure has been attained. This pressure differential between the reseating pressure and the set pressure is designated by the term "blowdown" and is generally about 8 to 10 lb. Fig. 4 illustrates the liquid-type spring-loaded safety valve, and Fig. 5 indicates the pattern of flow through the nozzle of a vapor-type spring-loaded safety valve.

This material taken from process-training-program manual, Baton Rouge, La., refinery of Esso Standard Oil Co.



SAFETY VALVE for liquid service. Fig. 4.



FLOW PATTERN in vapor-relief valves. Fig. 5.

DU PONT *Petroleum Chemicals* NEWS

Number 97 in a Series of Bulletins for the Petroleum Industry

JULY-AUGUST 1959

TEL overseas

How DuPont services the oil refineries of the world

Key Men In DuPont Export

WALTER MEES: For the past nine years, Walter Mees, at the left, export manager, has traveled up to 100,000 miles a year helping refiners all over the globe to use DuPont TEL and other additives efficiently. Holland-born and a graduate of a commercial and technical college in that country, he speaks five languages fluently and understands two more.

Before joining DuPont in 1950, Mr. Mees had 12 years' experience with the Royal Dutch Shell group, ranging from drilling to marketing to a management position in Venezuela.

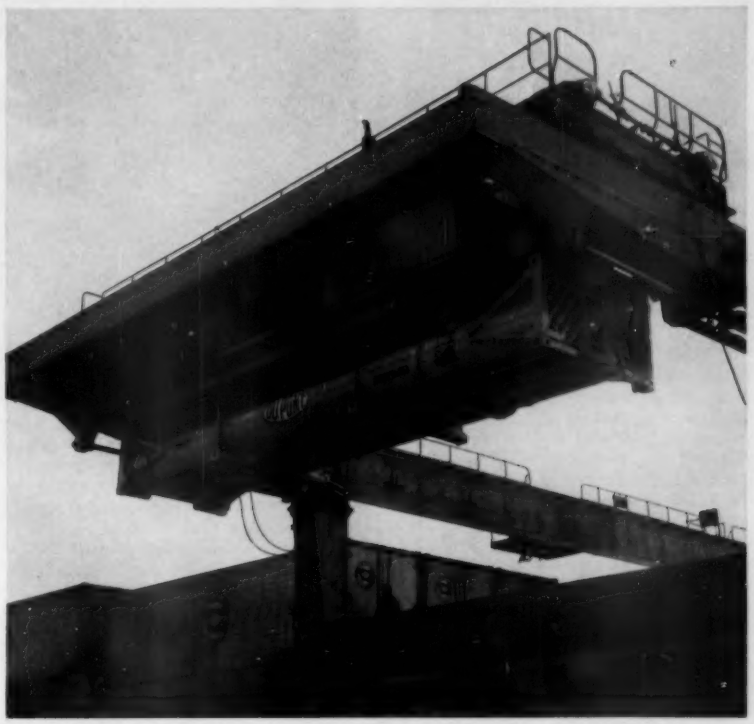
With his broad experience as a producer and marketer of petroleum products, plus his intimate knowledge of world-wide oil operations, Mr. Mees has become well-known for his success in offering DuPont's extensive services and resources to help solve the problems of oil men on all continents.

RENATO S. CARDOSO, above right, as an export account manager, handles much of the world-wide contact work of the Petroleum Chemicals Division.

Brazilian-born Mr. Cardoso studied in schools in Spain and Portugal before entering Columbia University in New York. He then transferred to the University of Pennsylvania to study chemistry.

He joined the Export Division of DuPont in 1936, after working for a year at the General Chemical Company. During World War II he served with the Army Chemical Corps and returned to DuPont in 1946. He was as-

CONTINUED OTHER SIDE



34,000-LB. CONTAINERS like these travel overseas. The one shown here is destined for Puerto Rico. All DuPont TEL sold overseas is made in the United States but not all ports can receive the containers shown, and drums are used in their place.

DuPont tetraethyl lead shipments are a familiar sight at Manaus, location of an oil refinery 1000 miles up the Amazon River . . . at Iquitos behind the Peruvian Andes . . . in all of Japan's refineries . . . and at dozens of other refineries throughout the world.

With TEL and with the many other DuPont petroleum additives sold overseas goes technical service similar to that enjoyed by refineries in the United States.

Generally, the service is of greatest importance. Like helping to design, test and start up TEL blending equipment. DuPont also trains plant personnel and keeps them up to date on such developments as dry dye eduction and DuPont's siphon starter.

Besides all this, there's routine servicing concerned with supplying basic technical literature and films and sales promotional material. Also, supervising the unloading of TEL and keeping it under close observation from manufacturing plant to blending plant. We furthermore take part in industry public relations and we cooperate with foreign governments insofar as public health is concerned.

If you'd like to know more about just what services are available and how they are obtained, please address Mr. Walter Mees, Export Sales Manager, DuPont Petroleum Chemicals Division, Wilmington 98, Delaware.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. duPont deNemours & Company (Inc.)

OVER

DU PONT *Petroleum Chemicals* NEWS

CONTINUED **Key Men**

signed to the Petroleum Chemicals Division at the beginning of this year. Mr. Cardoso speaks four languages.

Diesel fuels with FOA-2 and DMD stay stable, show no sludge

Small quantities of Du Pont Fuel Oil Additive No. 2 and Metal Deactivator can keep a diesel locomotive's injectors sliding free and its filters unplugged even when a blend of economy grade oils is used for fuel.

Recent field tests in Texas showed that adding 1.5 pounds of FOA-2 and 0.05 pound of DMD per 1000 gallons of oil solved an injector sticking problem plaguing several makes of tractors.

In a second test in the same area, just half the amount of additive solved a problem of filter clogging and injector sticking in truck engines.

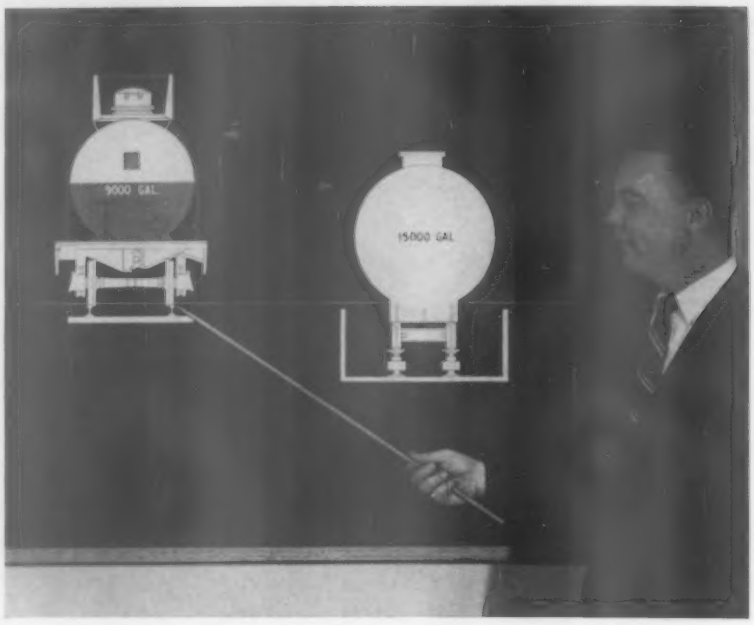
One company with a heavy-duty, high-speed diesel trucking fleet increased the life of its injectors two to three times simply by adding 1.25 pounds of FOA-2 to each 1000 gallons of fuel.

Your Du Pont representative – his office is listed below, right – can fill you in on the details of both these Du Pont additives. They are sold overseas as well as in the U.S.A.

Neoprene-modified asphalt roads show great promise in tests

Twelve different states are currently helping in tests involving roads laid with asphalt modified with Du Pont neoprene synthetic rubber.

The new combination appears to do a better job of holding cover stone in place and preventing weather from breaking through to the roads' bases.



New flannel board gives cues on TEL tank car unloading

To help you evaluate TEL unloading procedures for optimum efficiency, Du Pont has prepared a flannel board presentation which can simulate exactly actual plant conditions.

With the kit provided you can duplicate tank car size, size of weigh tank, and unloading line elevation in exact scale.

Calibrated cards show lift in inches Hg, vacuum needed for lift, and vacuum needed to start flow when you must overcome liquid pressure in the tank.

A slide rule shows quickly the rate of flow you can expect with a system, allowing for the variables of height, pipe friction, and pumping force.

If you're looking for a way to present such facts concisely and graphically to a group, contact the Du Pont representative nearest you. His office is listed in the box below.

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New York 20—45 Rockefeller Plaza . . . . . COlumbus 5-2342
Philadelphia 2—3 Penn Center Plaza . . LOcust 8-3531
Pittsburgh 22—1 Gateway Center . . . ATlantic 1-2933
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Better Things for Better Living
. . . through Chemistry

Du Pont Tetraethyl Lead and other Petroleum Additives

OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-11370

Printed in U.S.A.

Graphical solution to fluid-coning problems

Authors show how to draw charts and nomographs that make short work of tedious calculations. Method is based on original work of Muskat and Wyckoff in 1935.

BY C. PEREZ ROSALES, J. HEFFERAN VERA, AND E. G. LORETO MENDOZA
Reservoir Engineering Division, Production Department, Pemex, Mexico.

THE main objection to the application of Muskat and Wycoff's coning theory[1] lies in the cumbersome potential calculations involved. A graphical method for the partial solution of this problem has been published[2] and, potentiometric analyzers have provided other solutions for particular geometric systems[3]. Nevertheless, these methods are limited in their usages or else present technical inconveniences.

This article offers a nomographic procedure to perform potential computations in both non and partially penetrating wells. Two nomographs for specific values of well and drainage radii are included for determining the maximum pressure-drop without water or gas-cone breakthrough, as a function of the remaining geometric variables of the system and of the fluid density contrast.

Theoretical considerations . . . Potential distribution calculations in large disks with partially penetrating electrodes[4] constitute the fundamentals of the general equation for solving the coning problem in oil wells, Equation 16.

In the potential equations as used in Reference 4, the following dimensionless variables were introduced: $\rho = r/a$; $w = z/a$; $x = b/a$, where $a = 2h$, all symbols being defined at the end of the article.

Presented at the 1959 Fifth World Petroleum Congress.

Procedures to calculate ϕ_w, ϕ_e, and ϕ (o,z) values for non and partially penetrating wells are given here.

Nonpenetrating wells . . . In conformance with Equations 10 and 11 of Reference 4 for nonpenetrating wells, the potential can be expressed by:

$$\phi = (q/a)\left[4 \sum_{1}^{\infty} n K_o (2 \pi n \rho) \cos 2 \pi n w + 2 \ln 2/\rho\right] \quad (1)$$

$$\phi = (q/a)\left[-2 \psi (1 + w) + 2/w - \pi \cot \pi w\right] \quad (2)$$

In the following steps, arbitrarily $q/a = 2$.

ϕ_e Calculation.
Making $w = O$, $\rho = \rho_e$, Equation 1 becomes:

$$\phi_e = 8 \sum_{1}^{\infty} 1 n K_o (2 \pi n \rho_e) + 4 \ln 2/\rho_e \quad (3)$$

for values of $\rho_e > 0.8$, Equation 3 can be written

$$\phi_e \cong 4 \ln 2/\rho_e \quad (4)$$

or:

$$\phi_e \cong 5.54 + 9.21 (\log h - \log r_e) \quad (5)$$

Table 1

z/h	ϕ(o,z)
0.10	42.32
0.20	22.35
0.30	15.75
0.40	12.51
0.50	10.62
0.60	9.44
0.70	8.68
0.80	8.20
0.90	7.94
1.00	7.86

ϕ_w Calculation.
Making $w = \rho_w$ in Equation 2, ϕ_w can be expressed by:

$$\phi_w = -4 \psi (1 + \rho_w) + 4/\rho_w - 2 \pi \cot \pi \rho_w \quad (6)$$

For practical purposes ρ_w is comparatively small, consequently:

$$\Psi (1 + \rho_w) \cong -0.577 \text{ and}$$

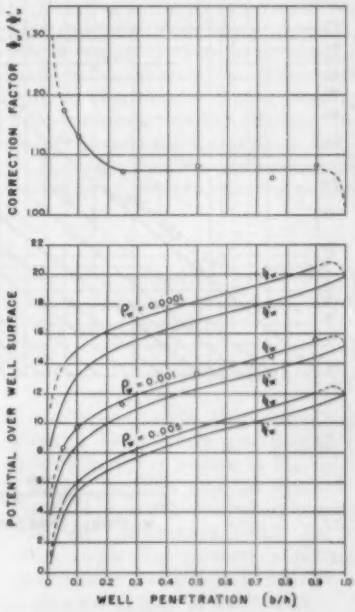
$$\pi \cot \pi \rho_w \cong 1/\rho_w$$

Therefore, Equation 6 reduces:

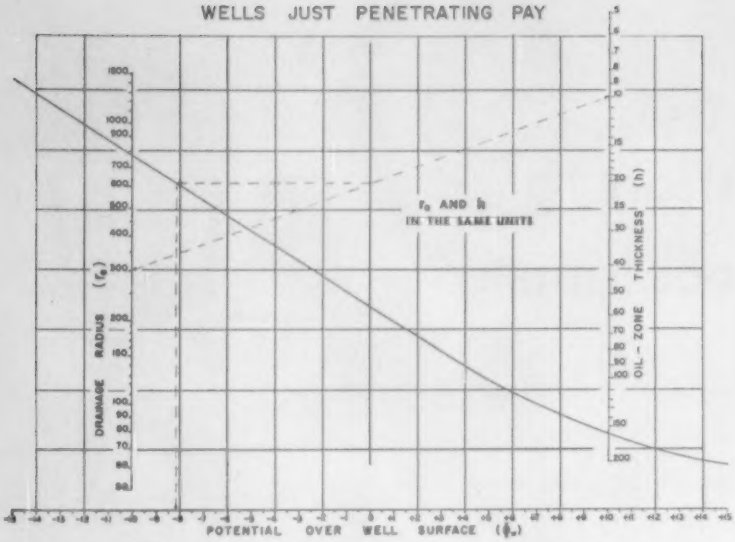
$$\phi_w \cong 2.31 + 4h/r_w \quad (7)$$

ϕ(o,z) Calculation.
The potential on z axis is obtained from Equation 2:

$$\phi(o,z) = 2\left[4h/z - 2 \psi (1 + z/2h) - \pi \cot \pi z/2h\right] \quad (8)$$



CORRECTION FACTOR, F_c, above, and potential, ϕ_e below, shown as functions of b/h. Fig. 1.


WELLS JUST PENETRATING PAY
DRAINAGE RADIUS (r_e)
r_e AND h IN THE SAME UNITS
OIL - ZONE THICKNESS (h)
POTENTIAL OVER WELL SURFACE (ϕ_w)

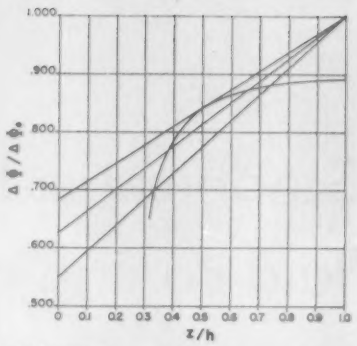
NOMOGRAPH for the solution of Equation 3. Fig. 2.

As ϕ (o,z) is independent of r_w, it is presented in Table 1, useful in all cases of nonpenetrating wells.

Partially penetrating wells . . . The following expressions were found by Muskat.

For small values of ρ,

$$\phi = q \{ - \ln \frac{\Gamma(1+w+x)\Gamma(1-w+x)}{\Gamma(1-w-x)\Gamma(1+w-x)} + \ln \frac{w+x+[\rho^2+(w+x)^2]^{1/2}}{w-x+[\rho^2+(w-x)^2]^{1/2}} - 1/4\ \rho^2 [\xi\ (2,1-w-x) - \xi\ (2,1-w+x) + \xi\ (2,1+w-x) - \xi\ (2,1+w+x)] + 0\ (\rho^4); \quad (9)$$

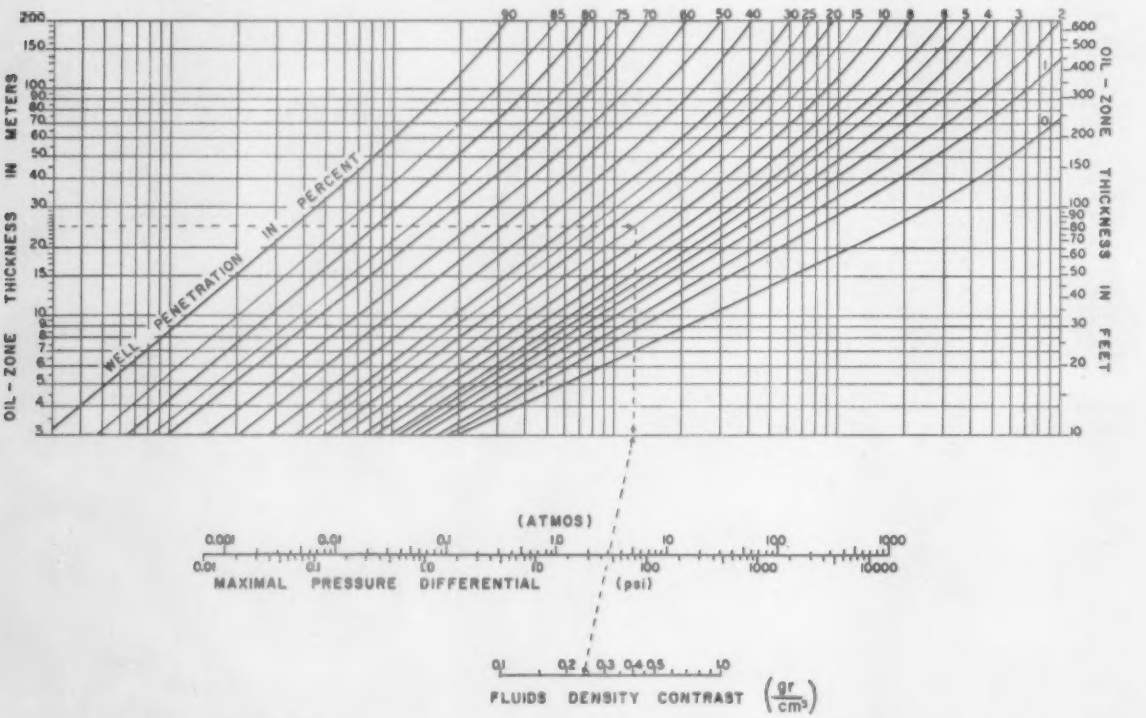


EXAMPLE of graphical solution of Equation 17. Fig. 3.

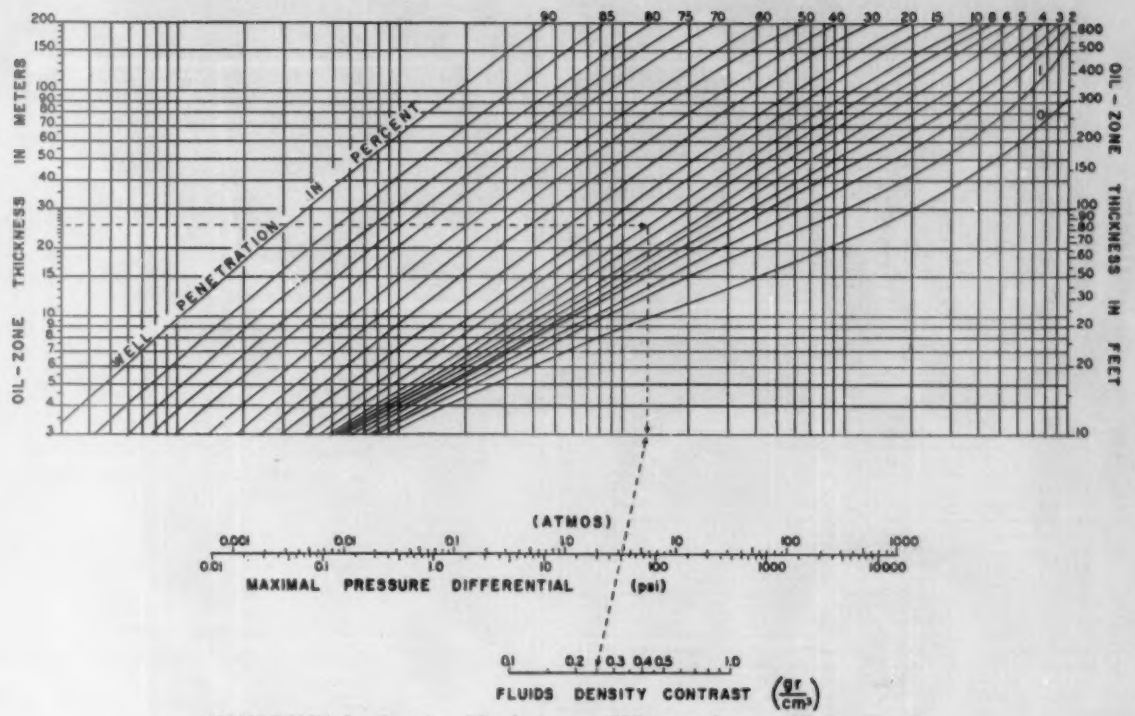
For large values of ρ,

$$\phi = 4q [1/\pi \sum_{1}^{\infty} 1/n\ k_o (2n\ \pi\ \rho) \cos 2n\ \pi w \sin 2n\ \pi\ x + x \ln 2/\rho] \quad (10)$$

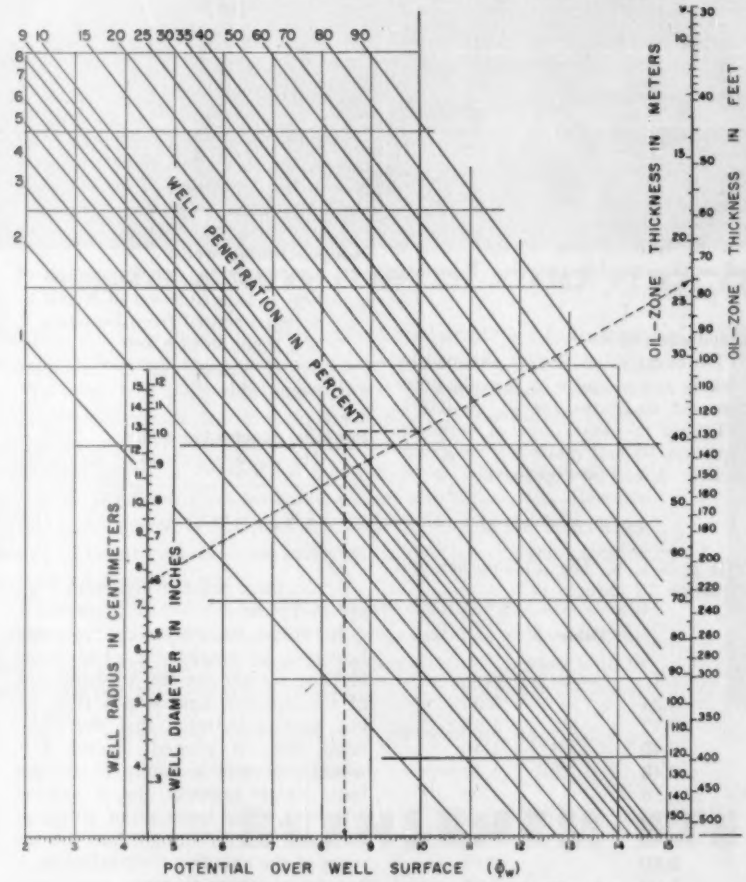
Latter equations do not satisfy the boundary condition: ϕ = const. when $\rho = \rho_w$ and $w \cong x$, because there is no uniform flux along the well surface as was supposed in the derivation of these expressions. More complicated compensated functions that fulfill this boundary condition for the value $\rho_w = 0.001$ and several x values for nonuniform flux were found by Muskat. An advantageous circumstance is the fact that an "effective average" of the potential, in the case of uniform


OIL - ZONE THICKNESS IN METERS
OIL - ZONE THICKNESS IN FEET
WELL PENETRATION IN PERCENT
(ATMOS)
MAXIMAL PRESSURE DIFFERENTIAL (psi)
FLUIDS DENSITY CONTRAST ($\frac{gr}{cm^3}$)

NOMOGRAPH for Equation 17 when r_e = 200 m. and r_w = 3⅞ in. Fig. 4.



NOMOGRAPH for Equation 17 when r_e = 200 m. and r_w = 8⅝ in. Fig. 5.


WELL PENETRATION IN PERCENT
OIL-ZONE THICKNESS IN METERS
OIL-ZONE THICKNESS IN FEET
WELL RADIUS IN CENTIMETERS
WELL DIAMETER IN INCHES
POTENTIAL OVER WELL SURFACE (ϕ_w)

NOMOGRAPH for solution of Equation 11. Fig. 6.

flux density, can be taken. Such a potential corresponds to that at w = ¾x and its use makes easier computations of ϕ_w and ϕ_c by means of Equations 9 and 10.

Calculation of ϕ_w

Denoting ϕ_w (at ρ_w = n) as the constant potential along the well surface, and ϕ_w (at ρ_w = n) as the potential on well surface at w = ¾x for uniform flux density, there will be a close approximation in results, assuming that the same ratio for ϕ_w (at ρ_w = 0.001) to ϕ_w (at ρ_w = 0.001) stands for other values of ρ_w. So, it may be written:

$$\phi_w \text{ (at } \rho = n)$$

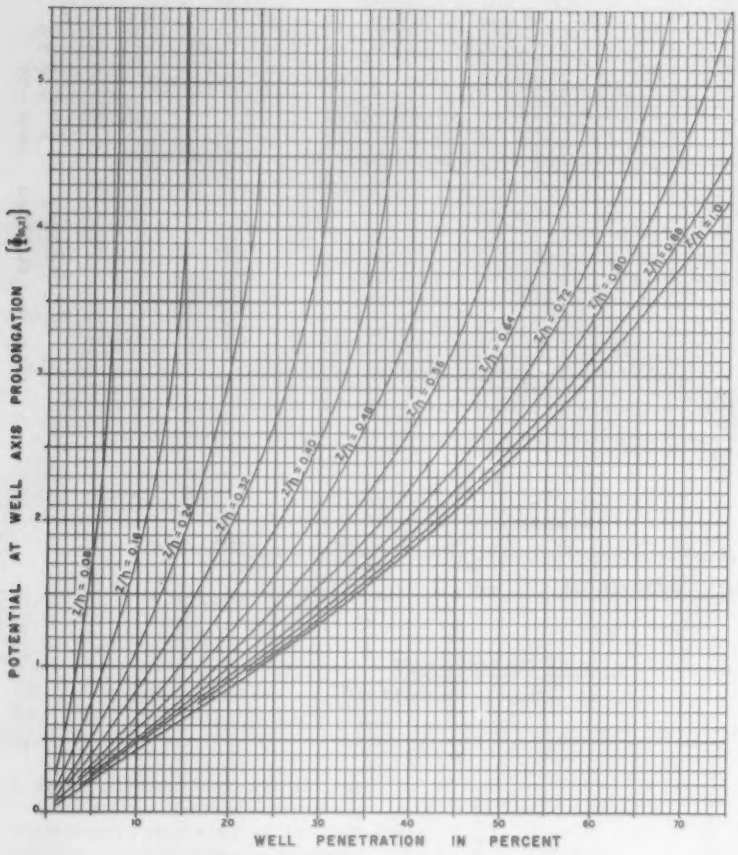
$$= \frac{\phi_w \text{ (at } \rho_w = 0.001)}{\phi_w' \text{ (at } \rho_w = 0.001)} \phi'_w \text{ (at } \rho_w = n)$$

$$= F_c\, \phi'_w \text{ (at } \rho_w = n) \qquad (11)$$

Correction-factor (F_c) values are given in Table 2 and were plotted vs. b/h in the upper section of Fig. 1

It can be seen that the correction factor is equal to one when there is complete penetration. This is the unique case that presents a uniform flux density because it is handled as a pure radial flow in the system.

In the lower section of Fig. 1 are ϕ_w and ϕ'_w values vs. b/h for three ρ_w values. The circles correspond to values computed by Muskat. ϕ_w curves



$\phi(o,z)$ values as a function of b/h and z/h. Fig. 7.

were extrapolated for small values of h following ϕ'_w trend calculated as low as 1% penetration. Fig. 6 is the nomographic solution of Equation 11.

Calculation of ϕ (o,z)

It has been observed that, for values of z greater than b, ϕ (o,z) is practically independent of well radius. Consequently, making use of the compensated equations for $\rho_w = 0.001$, the graph shown on Fig. 7, and suitable for any practical value of r_w, was devised. This graph was constructed so that, for any given penetration value b/h, the ϕ (o,z) value corresponding to any z/h value greater than b/h, can be obtained. For example, for a 20% penetration well, the values are as shown in Table 3.

Only four or five ϕ (o,z) vs. z/h values are needed to solve Equation 17 graphically.

Calculation of ϕ_e

The exact value of ϕ_e is obtained by making $\rho = \rho_e$ and $w = 0$ in the compensated equations for $\rho_w = 0.001$.

Taking the first term of series in Equation 10 and making $\rho = \rho_e$ and $w = 0$. ϕ_e can be expressed.

$$\phi_e = 4\ [(1/\pi)\ K_o\ (2\ \pi\ \rho_e)\ \sin 2\ \pi\ x + x \ln (2/\rho_e)] \quad (12)$$

If $\rho_e > 1$, $K_o\ (2\pi\ \rho_e)$ vanishes and Equation 12 reduces to:

$$\phi_e = 4 \times \ln 2/\rho_e \quad (13)$$

In the case of ϕ_e, similar considerations as those in ϕ_w calculation can be made and the same correction factors applied.

Consequently, for $0.90 > h > 0.20$ values, Equation 13 becomes:

$$\phi_e = 1.075\ (4 \times \ln 2/\rho_e) \quad (14)$$

and finally when

$$r_e > 2h \text{ and } 0.90 > h > 0.20$$

$$\phi_e = 4.95\ h\ (0.602 - \log r_e + \log h) \quad (15)$$

ϕ_e values can be calculated through nomograph of Fig. 4.

Solution . . . The general equation[1] dealing with cones in static equilibrium is stated as follows:

$$\frac{\Delta\phi\,(r,z)}{(\Delta\phi)_e} = 1 - \frac{g\ h\ \Delta\gamma}{\Delta P}\left(1 - \frac{z}{h}\right) \quad (16)$$

As the maximal cone heights are obtained at well axis prolongation, it is convenient to restrict the computations of the potential distributions along this axis. Consequently, Equation 16 takes the form:

$$\frac{\phi_w - \phi(o,z)}{\phi_w - \phi_e} = 1 - \frac{g\ h\ \Delta\gamma}{\Delta P}\left(1 - \frac{z}{h}\right) \quad (17)$$

According to the equations discussed above, all the potential values included in Equation 17 can be readily computed as follows:

Nonpenetrating wells:

ϕ_e is given by the nomograph of Fig. 2, as a function of h and r_e.
ϕ_w is computed from Equation 7, as a function of h and r_w.
ϕ (o,z) values can be obtained from Table 1.

Partially penetrating wells:

The ϕ_w, ϕ (o,z), and ϕ_e values are obtained, respectively, from Figs. 6, 7, and 8.

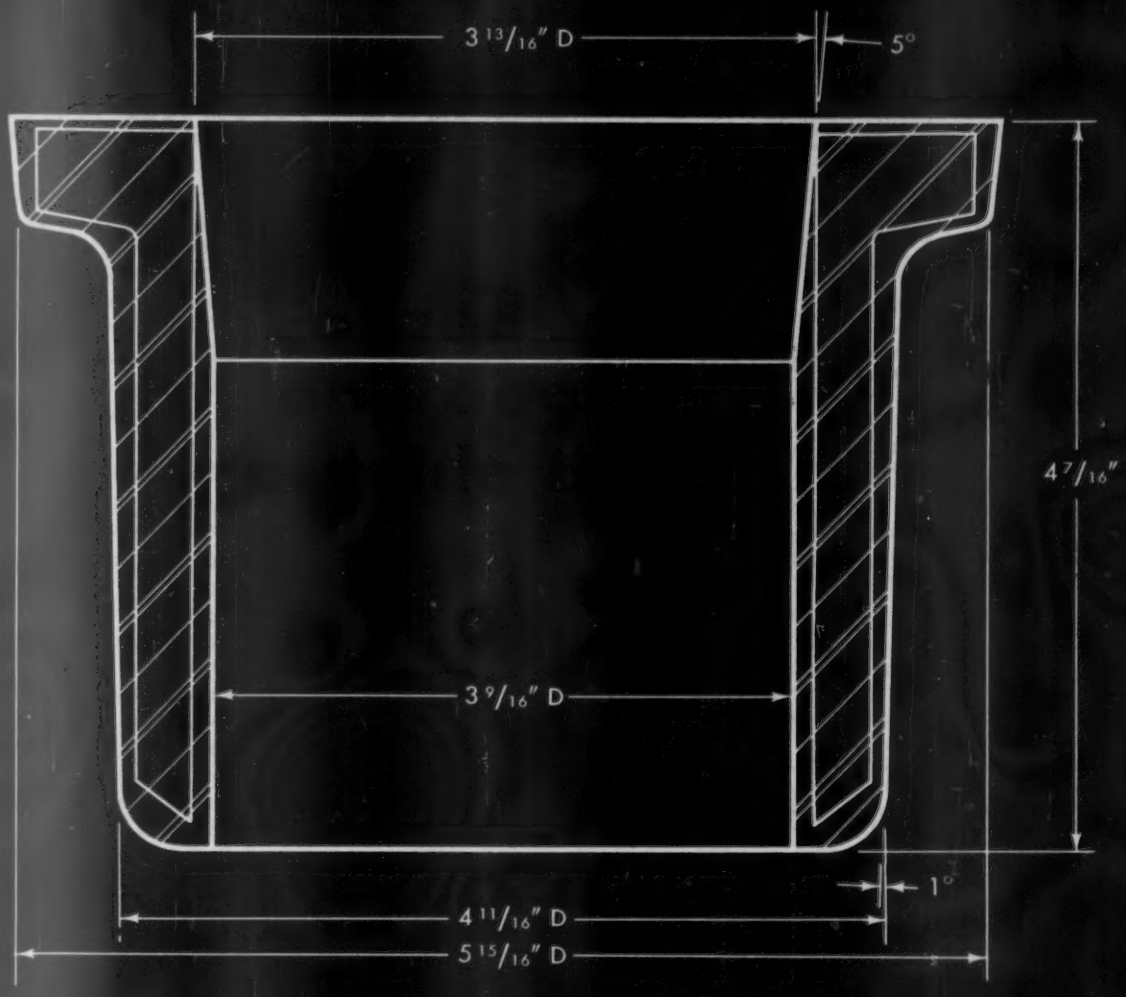
It would be convenient to solve Equation 17 graphically. This could be done by plotting the left-hand side of the equation against z/h (Fig. 3), but bearing in mind that the right-hand side, if plotted against z/h, would represent a family of straight lines which intersect the z axis at $z/h = 1$. The intersection points of the curve and the straight lines are the roots of the equation. Nevertheless, it has been shown that the only roots

Table 2

Well Penetration	$F_c = \frac{\phi_w\ (\rho_w = 0.001)}{\phi'_w\ (\rho_w = 0.001)}$
0.05	1.174
0.10	1.132
0.25	1.074
0.50	1.082
0.75	1.062
0.90	1.082
1.00	1.000

Table 3

z/h	ϕ (o,z)
0.24	3.05
0.32	1.95
0.40	1.46
0.48	1.23
0.56	1.08
0.64	1.00
0.72	0.94
0.80	0.90
1.00	0.86



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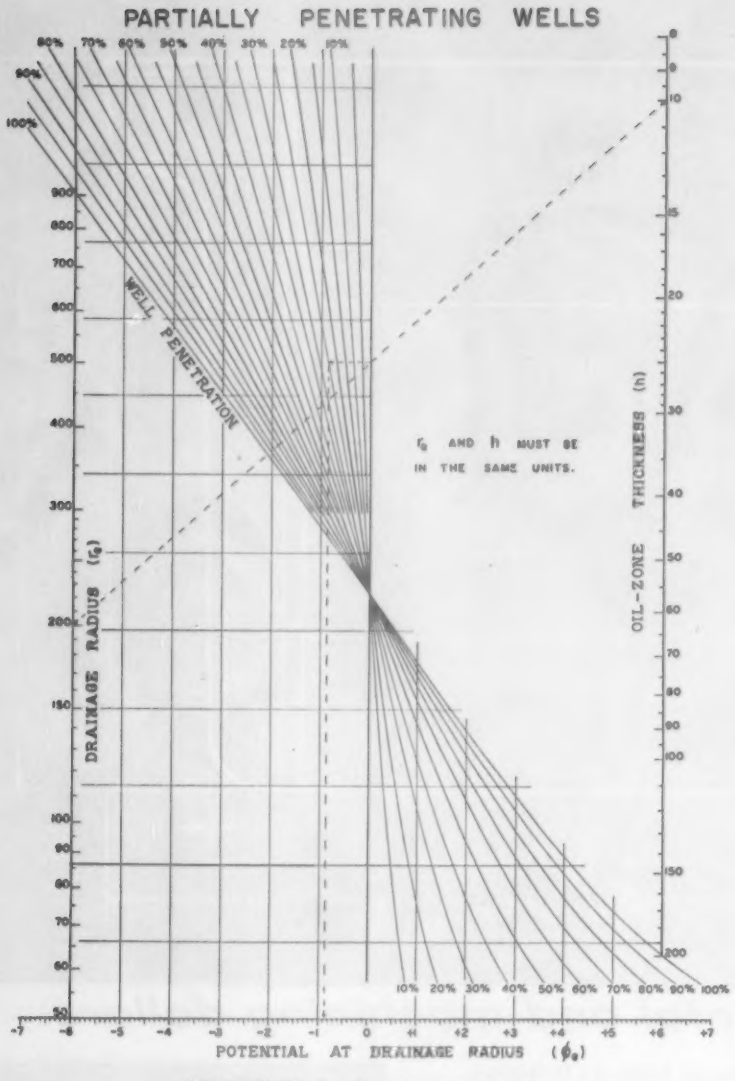
PARTIALLY PENETRATING WELLS
WELL PENETRATION
DRAINAGE RADIUS (r_e)
OIL-ZONE THICKNESS (h)
r_e AND h MUST BE IN THE SAME UNITS.
POTENTIAL AT DRAINAGE RADIUS (ϕ_e)

NOMOGRAPH for Equation 15. Fig. 8.

with physical significance for cones in static equilibrium are those for which the slope m of the straight lines exceeds that of the curve. The critical cone height is given by the point of tangency of the curve with the minimum slope straight line. Consequently, the corresponding maximum pressure differential is expressed by:

$$\Delta P_{max} = \frac{gh\,\Delta\gamma}{m_{min}} \qquad (18)$$

Two nomographs giving ΔP_{max} values in function of h, **h** and $\Delta\gamma$, for specific r_e and r_w values, have been constructed. That of Fig. 4 applies to r_e = 200 m. and r_w = 3⅞ in., and that of Fig. 5 to r_e = 200 m. and r_w = 8⅝ in. The following example illustrates their use. Assume h = 25 m., r_e = 200 m., D_w = 8⅝ in., **h** = 0.10, and $\Delta\gamma$ = 0.25 g./cm³, (oil and water). By means of Fig. 5, one can immediately determine that ΔP max = 50 psi.

The solution of the simultaneous water and gas-coning problem, based on the method proposed by Arthur[2], is thus simplified to a great extent, particularly by the nomograph shown herewith as Fig. 6.

Acknowledgment

The writers express recognition to José Colomo, subdirector técnico de producción, and Alfonso Barnetche, gerente de explotación, for permission and facilities given to publish this paper.

List of Symbols

- ϕ = Velocity potential
- ϕ_w = Constant potential along well surface
- ϕ'_w = Potential on well surface at w = 3/4 x
- $\phi(o,z)$ = Potential along well axis for values of z greater than b
- ϕ_e = Constant potential at the external boundary r_e
- ρ = Radius parameter = r/2h
- w = Depth parameter = z/2h
- x = Penetration parameter = b/2h
- h = Oil-zone thickness
- **h** = Well penetration as a fraction of h; **h** = b/h
- b = Well penetration, in length units
- a = Double oil-thickness
- z = Well axis, positive direction downwards
- r = Radial distance
- r_w = Well radius
- r_e = External boundary radius
- D_w = Well diameter
- ln = Natural logarithm
- log = Logarithm of base 10
- $K_0(y)$ = Hankel function of order 0
- $\Gamma(y)$ = Gamma function
- $\Psi(y)$ = Psi function = $\Gamma(y)/\Gamma'(y)$
- $\xi(s,y)$ = Zeta function of Riemann
- ΔP = Total pressure drop in oil-zone, as measured at top of pay
- ΔP_{max} = Maximum pressure drawdown without water or gas cone breakthrough
- m = Slope
- q = Flux density
- g = Gravity acceleration
- F_c = Correction factor = ϕ_w/ϕ'_w
- $\Delta\gamma$ = Density contrast between the two fluids in contact, as measured at reservoir conditions.

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Low-density cement–
Lost-circulation slurry–
Gilsonite gives both

Gilsonite has been used on more than 200 jobs since it was introduced as a cement additive in 1957. Operations included primary cementing through lost-circulation zones behind surface, intermediate, and production pipe. They also included single and multiple stages. Other operations were various remedial jobs such as squeezing, recementing above inadequate fillup, and plugging back to regain mud circulation.

GILSONITE has unusual properties as an additive for oil-well cement slurries. Some of them are:

1. Low in specific gravity (1.07).
2. Impermeable.
3. Resistant to corrosive fluids.
4. Chemically inert.
5. Requires little water for a slurry.

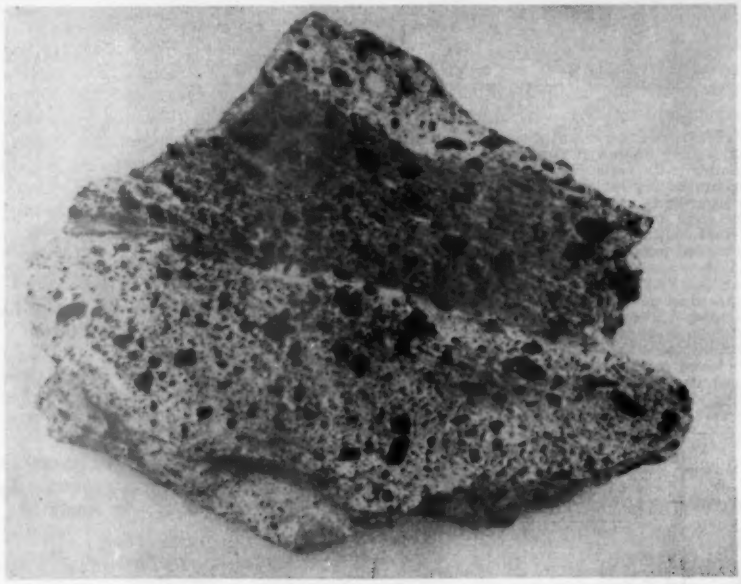
These features combine with a good particle-size distribution to produce a slurry which has:

1. Low weight.
2. High compressive strength for its weight.
3. Compatibility with other slurry additives.
4. Exceptionally good bridging qualities.

Because of this, gilsonite slurries have had excellent results in areas of incompetent formations as well as in other types of lost-circulation zones. In the field, gilsonite has generally obtained 80 to 90% fillup where other types of slurries get only 50 to 60%.

From a paper titled, "Gilsonite—A Unique Additive for Oil-Well Cements," presented at 1959 meeting, API Division of Production, Southern District, New Orleans.

BY KNOX A. SLAGLE AND L. GREGORY CARTER
Halliburton Oil Well Cementing Co., Duncan, Okla.



APPEARANCE and even distribution of gilsonite in a set-cement sample are seen in this photograph. Fig. 1.

Long needed . . . Many materials have been used in the attempt to restore circulation while cementing. Sometimes simply reducing the slurry density has given good-enough results. In other instances, bridging materials were helpful. But there still remained zones of loss which would not react satisfactorily to either of the methods. Combinations of the two approaches have been tried, but it has been hard to get optimum bridging and density without loss of such desirable slurry properties as strength and resistance to corrosive fluids.

Bentonite, in concentrations up to 12%, is a material used extensively. Primary purposes of bentonite in cement is to decrease weight and increase volume of the slurry. Bentonite has an ability to absorb relatively large amounts of water. This water, in excess of that required for the cement reaction, cuts the strength of the cement and contributes to its lower resistance to corrosive waters, high temperatures, and other detrimental downhole conditions.

Diatomaceous earth is another material used as a lightweight additive. It has an extremely high surface area. As a result, large quantities of water are needed to produce a pumpable slurry. This reduces compressive strength.

Though these two materials do reduce the strength of cement, they generally provide enough for normal cementing operations. Their big disadvantage for use in lost-circulation zones is the lack of coarse bridging particles. Using coarse additives in these slurries is possible, but may further reduce compressive strength. Materials such as ground nut shells, granulated plastics, and cellophane flakes have been used as bridging agents with

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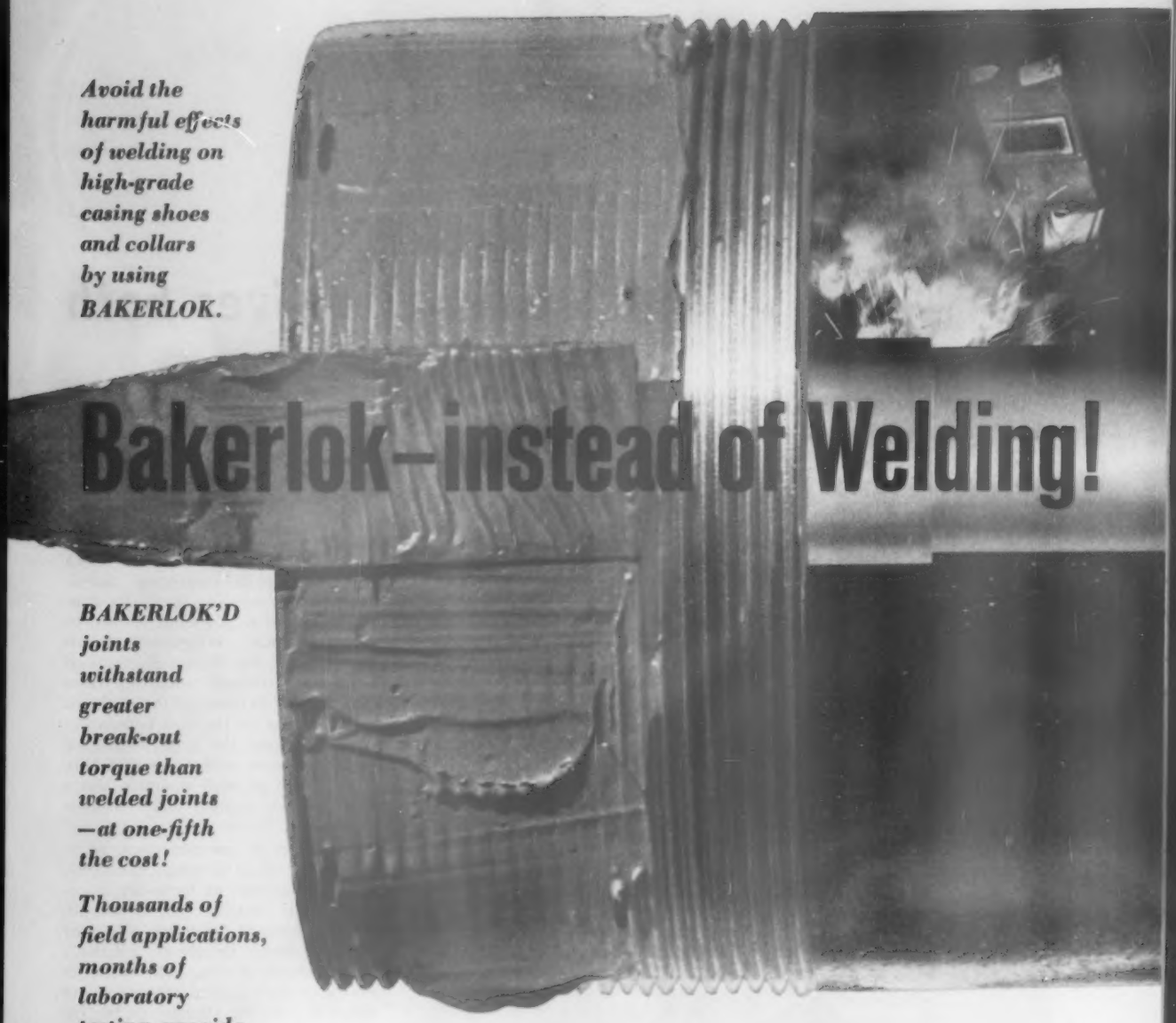

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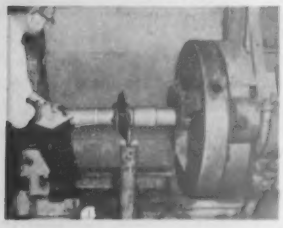

The break-out tester (above) was used repeatedly for simultaneous breaking-out of identically made-up joints, one with BAKERLOK on the *pin threads only*, and the other joint welded with three two-inch beads. Gradually increasing torque was applied, and . . . time after time the welded joints broke first. Further tests under constant vibration, with variances in make-up and temperature proved beyond question that BAKERLOK was far superior to welding.

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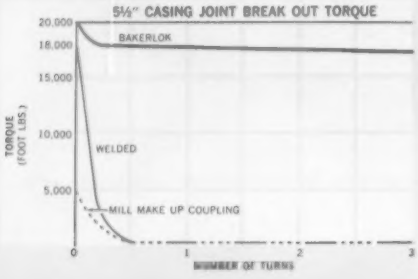

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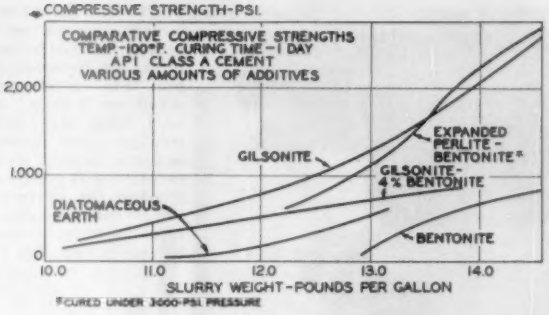


Fig. 2.

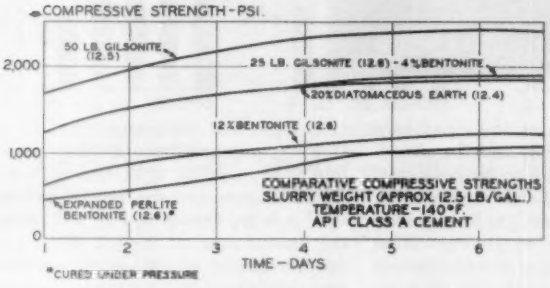


Fig. 4.

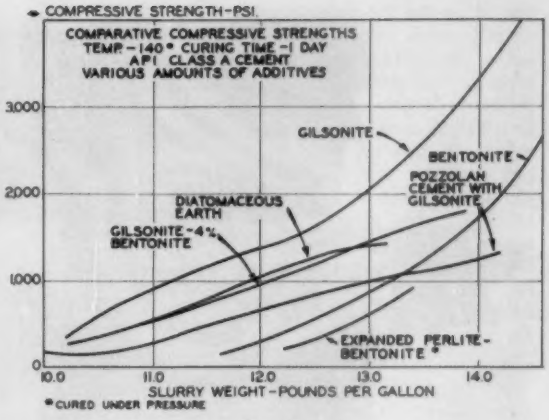


Fig. 3.

RESULTS of compressive-strength tests made with various ratios of gilsonite with different basic cementing composition under varying curing temperatures.

excellent results where lost-circulation problems were minor, but they have not been too successful on major difficulties.

Slurry weight can be reduced moderately with pozzolanic additives. Because a pozzolan reacts with the hydrated lime from the cement to yield cementitious compounds, strengths are good and bridging materials may be used.

Expanded perlites have been used since 1951 for both lost-circulation control and moderately light slurry weight. In order to have a pumpable slurry extra mixing water is required because the expanded perlite contains small air cells. When subjected to pressure in a well the walls of these cells will break down and accept water from the slurry, causing a slight dehydration which might result in reduced pumpability if not enough mixing water were used.

All these various types of slurries have ability to control lost circulation under some limited conditions. Certain areas may obtain adequate results from them. However, none have shown the over-all effectiveness, particularly in the severe lost-circulation zones, that gilsonite does.

Source of gilsonite . . . Gilsonite is a solid hydrocarbon that occurs in the Uinta basin of Utah and Colorado. These are not only the largest deposits in the world, but also the most extensively developed. It was discovered in 1885 by Capt. Samuel Gilson, hence the name gilsonite.

It has been generally grouped as a form of native asphalt, but its unusual properties make it markedly different from the bitumens or asphalts which may range from liquid to definite solid form whether native or processed. Gilsonite is mineralogically classified as an asphaltite. This material was deposited on roughly parallel lines running from a northwest to a southeast direction and it occurs in vertical fissures rather than in beds, pools, or lakes where the bitumens and asphalts are found.

Gilsonite also has many uses other than for cements. Its properties make it valuable for both heat and electrical-insulation applications. Floor tile, roofing materials, acid-resisting paints, electrical-insulating varnish, battery boxes, and brake and clutch linings all contain finite quantities of gilsonite. It is used in underbody coatings for cars, printing ink, and other items where its black color can be used to advantage.

Why it was picked . . . Gilsonite was first evaluated as a density-reducing additive for cementing slurries because of its low specific gravity (1.07). Laboratory testing was set up to establish an optimum particle size with three primary points considered:

TABLE 1—PHYSICAL PROPERTIES OF GILSONITE

Specific gravity	1.07
Bulk density, lb. per cu. ft.	50
Water requirement, gal. per bulk cu. ft. (approx.)	2
Melting point, °F.	385 to 525

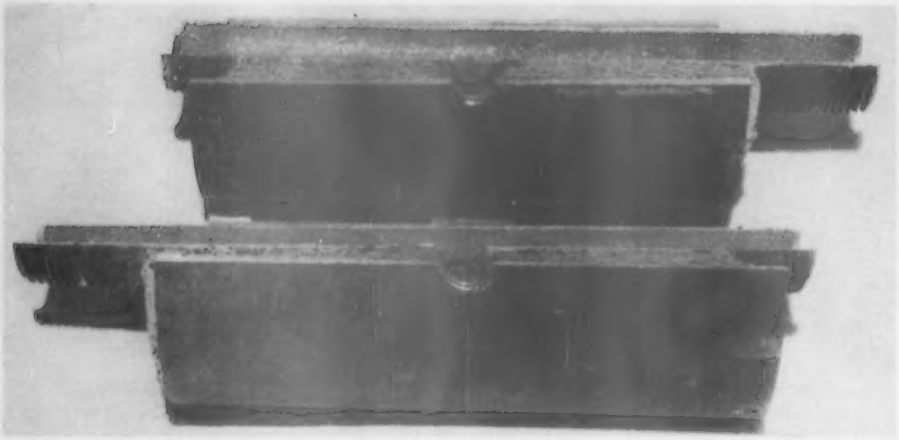
1. Maximum size to permit pumping through downhole cementing equipment such as float collars and multiple-stage collars.
2. Minimum size to control lost-circulation zones.
3. Proper particle-size distribution to obtain the two preceding objectives and to also allow slurry preparation with a minimum amount of mixing water.

Physical properties of the material ultimately selected are shown in Table 1. Fig. 1 shows the appearance and even distribution of gilsonite in a set-cement sample.

Gilsonite should have the following advantages:

1. Low slurry densities because of the specific gravity of the solid gilsonite rather than because of large volumes of water.
2. Higher compressive strengths for its slurry weight because solid particles are added instead of adding water.
3. Compatibility with existing retarders, accelerators, low-water-loss materials, and other slurry additives inasmuch as the solid hydrocarbon would be chemically inert in a cement system.
4. Protection against premature dehydration of the slurry because the gilsonite is impermeable and nonporous.
5. Equal or superior resistance to corrosive waters because the material itself is chemically resistant to both acidic and alkaline solutions.
6. Excellent control of lost-circulation zones with a granular bridging material strong enough to withstand moderate squeeze pressures and yet soft enough to permit pressure deformation providing an effective seal against loss.

Good in lab tests . . . Further laboratory tests backed up these concepts. Compressive-strength tests were made with various ratios of gilsonite with



IN TESTS, a gilsonite-cement column was placed in the annular space between 1 and 3-in. pipe and cured for 3 days. A hole was drilled through both pipes and the cement, and kerosine was pumped through the perforation. The samples, after testing, were sawed in two. Fig. 5.

different basic cementing compositions under varying curing temperatures. The results of these tests are shown on Figs. 2, 3, and 4. It can be seen that at equal slurry weight, higher strengths are generally possible when additives permit the use of lower water ratios such as recommended for gilsonite.

Thickening-time tests were made on the Pan American high-pressure thickening-time tester at simulated well depths of 8,000 and 10,000 ft. These tests showed the effect of gilsonite on the pumpability of neat cement, and cement containing bentonite, a calcium lignosulfonate retarder, or a pozzolanic additive. There was virtually no difference in thickening times of these slurries containing 0 or 50 lb. of gilsonite per sack, indicating the chemical inertness of gilsonite and the practicability of using other additives in conjunction with it.

Another series of compressive-strength tests was made using gilsonite with calcium chloride as an accelerator. It was found that acceleration of compressive-strength buildup was obtained in about the same order of magnitude, percentagewise, as occurs with other types of cementing slurries.

Density was measured on set specimens cured under 0 and 3,000 psi. to show any difference which would result from compression of air in void spaces and indicate porosity within the gilsonite. There were no measurable differences in this group of tests, thereby showing that no voids exist within the gilsonite particles.

The ability of gilsonite to control lost-circulation problems was tested by the two general methods outlined in API RP 29.[5] Effectiveness in porous formations was measured on a graded-limestone gravel bed with permeability of approximately 450 darcies. Fractures were simulated by use of slots of various widths machined in metal slugs. Complete duplication of field conditions in lost-circulation zones is very difficult and the results of these tests are not to be construed as absolutely valid with respect to what volume of loss might be expected in a well. However, as a comparative method for evaluating lost-circulation materials the gravel bed has been found useful.

Table 2 shows a portion of the data obtained during these tests comparing gilsonite to expanded perlite, an additive which has probably been more widely used as a bridging agent to reduce slurry loss than any other prior to the introduction of gilsonite. As concentration of the additives increased, the gilsonite definitely permitted less loss of slurry and in actual field usage gilsonite has also been superior in providing maximum fillup through lost-circulation zones.

Laboratory tests have also been made to determine the effect of various oils on gilsonite cement. Gilsonite itself, being a hydrocarbon, is soluble to a certain extent. It is more soluble in solvents such as kerosine and naphtha than it is in various crude oils available for tests.

In tests, a gilsonite-cement column was placed in the annular space between 1 and 3-in. pipe and cured for 3 days. A hole was drilled through both pipes and the cement, and kerosine was pumped through the perforation. The samples, after testing, were sawed in two and the results of one such test are shown in Fig. 5. During the limited time of the test there was no detrimental effect on the cement, and there was only a slight dissolving of exposed gilsonite particles. There should be very little effect beyond the exposed particles of gilsonite because of the cement boundary between particles, but further testing is being considered for longer times and at higher temperatures. Room temperature was used during this first test.

TABLE 2—LOST-CIRCULATION TESTS USING API CLASS A CEMENT

Formation characteristics:
Graduation—¼ to ½-in. crushed limestone.
Permeability—approximately 450 darcies.
Differential pressure at shutoff—1,000 psi.

Cu. ft. of additive per sack of cement	Total slurry loss before shutoff*	
	Gilsonite	Expanded perlite
1/8	0.424	0.456
1/6	0.363	0.406
1/2	0.245	0.492
1	0.291	0.458

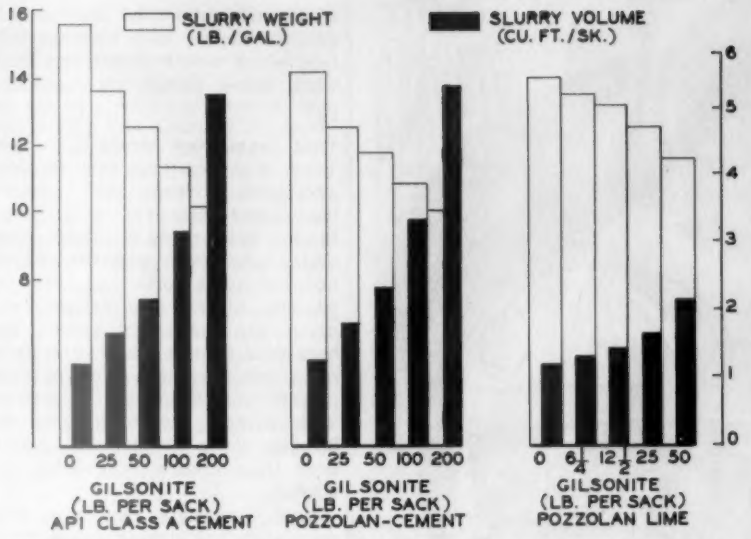
*Slurry loss expressed in cubic feet per square foot of formation area.

High-temperature softening and aglomeration of gilsonite has also been studied. Up to temperatures of 240° F., with pure gilsonite, there was no apparent sticking together of the separate particles, indicating no appreciable softening of the material. Because of the temperature reduction during circulation, there should not be any formation of a plastic mass while circulating gilsonite at bottomhole static temperatures of 300° F. or slightly above.

Fig. 6 shows slurry weight and slurry-volume data for three types of cementing slurries containing various quantities of gilsonite. As the specific gravity of gilsonite is very nearly the same as that of water, almost identical slurry factors are obtained upon the addition of gilsonite as would be obtained with the addition of an equal weight of water. Volumewise 1 bulk cubic foot of gilsonite (50 lb.) plus the 2 gal. of mixing water occupies 1.02 cu. ft. so that slurry yield with this additive is relatively high for each sack of cement used.

Field Results

Gilsonite has been used in nearly all areas of the country. Table 3 lists the types of jobs performed in the various areas. The amount of gilsonite



SLURRY-WEIGHT and slurry-volume data for three types of cementing slurries containing various quantities of gilsonite. Fig. 6.

used on these jobs in respect to the type of cementing composition and other additives is given in Table 4.

In Oklahoma . . . Most of the gilsonite-cement jobs performed in Oklahoma were squeeze jobs to correct inadequate fillup. In one southern Oklahoma field a 1,500-psi. dry test was obtained after a squeeze job using 25 lb. of gilsonite per sack of API Class A cement with a low-water-loss additive and an accelerator. This successful repair job followed six other attempts with various types of cementing compositions during which it was impossible to attain a satisfactory squeeze pressure.

Since this initial success, four other wells in the same field were satisfactorily squeezed on the first attempt using gilsonite squeeze pressures of 2,000 to 4,500 psi. These jobs were in a rotten-shale section and gilsonite cement may be used for primary cementing in an attempt to avoid the remedial jobs.

In another field one zone in a well was to be isolated for salt-water disposal. Three attempts, with 100 to 150-sack batches of API Class A cement with a low-water-loss additive each time, got no squeeze pressure through the perforations. A blend of 15 lb. of gilsonite per sack of cement plus a low-water-loss additive was tried and a pressure of 4,000 psi. obtained after 15 sacks were displaced into the formation. Excess cement was backwashed and the squeeze tested to 3,000 psi. After cement had set under 1,500-psi. pressure, no cement was found inside the pipe and the perforations were tested to 3,000 psi. without any leaks.

North Central Texas . . . Only a few gilsonite cement slurries have been used in the North Central Texas area inasmuch as lost circulation has not been a serious problem, but there was one very interesting operation. Fillup was insufficient on the primary-cementing job without gilsonite so eight perforations were placed in the casing over a 2-ft. interval above the top of the cement at approximately 3,850 ft. A pozzolanic-cement slurry containing 100 lb. of gilsonite per sack and mixed at 10.8 lb. per gal. was circulated through these perforations to approximately 2,700 ft. where a split was found in the 5½-in. casing. The packer was then raised above this split and the remaining slurry displaced at this point to bring the cement column to 2,100 ft. The upper stage was overdisplaced with 5 bbl. of water and the split casing was later repaired by squeezing.

A significant point from this job was that a high concentration of gilsonite was successfully pumped through eight perforations and through a split in the pipe without premature bridging.

Arkansas and Gulf Coast . . . In southern Arkansas there is a field with two to five gas pays. Usually it requires a two-stage cementing collar plus squeeze work to get proper fillup and allow separate fracturing of each zone. Three gilsonite-cement jobs with a pozzolan-cement blend have been done in this area without the benefit of a stage collar. Fillup was adequate and no squeezing was required to segregate the producing intervals. Other jobs in this general area have utilized gilsonite for its bridging effect in squeeze cementing, with all jobs reported thus far being satisfactory.

The Texas Gulf Coast area has primarily used this material for plug-back operations for lost circulation in fractured and faulted formations where several wells have been lost. Results have been very good in re-

TABLE 3—TYPE OF JOBS AND AREAS WHERE PERFORMED

Area—	Total jobs	Production*	Intermediate†	Surface‡	Squeeze	Plug-back	Recement§
Oklahoma	10	1	1	..	6	2	..
Illinois-Indiana	4	..	..	..	1	3	..
Rocky Mountain	5	1	..	1	..	..	3
Central Texas	2	..	..	..	1	1	..
North Louisiana-Mississippi	6	4	..	..	2	..	..
East Texas	4	..	..	..	1	2	1
West Texas	28	14	2	..	3	8	1
Texas Gulf Coast	28	..	..	3	..	25	..
South Louisiana	24	2	4	18	..	..	..
New Mexico	15	10	1	1	..	3	..
Kansas-Texas Panhandle	74	31	4	3	15	18	3
Total	200	63	12	26	29	62	8

*Production-casing jobs including primary cementing and liner cementing. †Intermediate casing, primary cementing. ‡Surface and conductor casing, primary cementing §Displacing slurry above existing cementing job to obtain adequate fillup.

TABLE 4—MATERIALS USED FOR GILSONITE CEMENT JOBS

Type of basic cementing composition—	Pounds of gilsonite per sack						Additives*
	6-24	25-49	50-74	75	100	200	
API Class A cement	6	42	20	14	5	1	41
API Class C cement	..	..	4	..	..	..	1
API Class E cement	..	3	..	..	..	..	2
Bentonite cement	..	13	4	3	1	1	9
Pozzolan cement	11	45	17	3	2	..	20
Pozzolan lime	2	3	..	..	..	..	2
Total	19	106	45	20	8	2	75

*Other additives used included: accelerators, retarders, low-fluid-loss additives, diatomaceous earth, salt-water slurries, and other lost-circulation materials.

Congrats and $25 for this quip to M. H. Barber, Continental Oil Co., Big Spring, Texas.

"told him to pack the pump"

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storing circulation. In another field gilsonite slurries have been the only type which would permit circulation while setting surface and conductor pipe.

West Texas, New Mexico . . . West Texas is a notorious area for lost-circulation problems and gilsonite has proved successful in this area. In one field, there is trouble when setting production pipe because of two very weak formations. Prior to gilsonite, all types of bridging materials and lightweight slurries had been tried with at least two or three stages being required. Most of these jobs showed fluctuations in pressure while pumping which indicated the breaking down of the weak formations while cement was being circulated.

Five single-stage jobs have been reported using Gilsonite with a steady buildup of pressure from the time cement reaches the formations until the top plug was landed. Temperature surveys indicated fillup of 90 percent or better on each of these jobs whereas other types of slurries required more slurry volume and staging in order to attain this fillup.

The majority of jobs in New Mexico have been setting production liners in gas wells where extremely weak formations exist. The first two jobs run in this area were on gas-drilled wells at approximately 6,000 ft. with 5½-in. production liner set in 6¾-in. hole. Both jobs were cemented using API Class A cement containing gilsonite. After the liner was cemented, the drill pipe was raised to reverse out any excess slurry above the top of the liner. Gilsonite-cement slurry returned to the surface on both jobs, indicating that cement had completely circulated the liner. Calculations indicated that only 25 to 35% excess volume of gilsonite cement was needed to circulate the liners compared to 200% excess used with other additives without being able to circulate completely.

In another field in New Mexico cement could not previously be circulated on a long string because of a weak coal bed near the top of the producing zone. Wells in this area that have been cemented using gilsonite have been very successful with slurry being circulated out during the jobs indicating no loss to the thief zones.

Kansas, Panhandle . . . Much gilsonite has been used in the Texas Panhandle-Kansas area both for lost-circulation problems and also for a better cementing job where lost circulation was not a problem.

In one field, a well finally had to

be shut down because the hole could not be filled with mud containing other lost-circulation materials. Fluid level was approximately 650 ft. from the surface. Gilsonite cement was used to set a 7-in. casing at the depth of lost circulation and returns were established for the first time.

Drilling continued with returns lost at four additional formations. In each instance API Class A cement containing 100 lb. of gilsonite per sack of cement was used in a plug-back. This allowed a standing pressure of 800 to 1,500 psi. to be placed on each zone of loss. When drilling was resumed through each plug, complete circulation was regained. Many wells in this area prior to introduction of gilsonite had to be abandoned because of severe lost circulation.

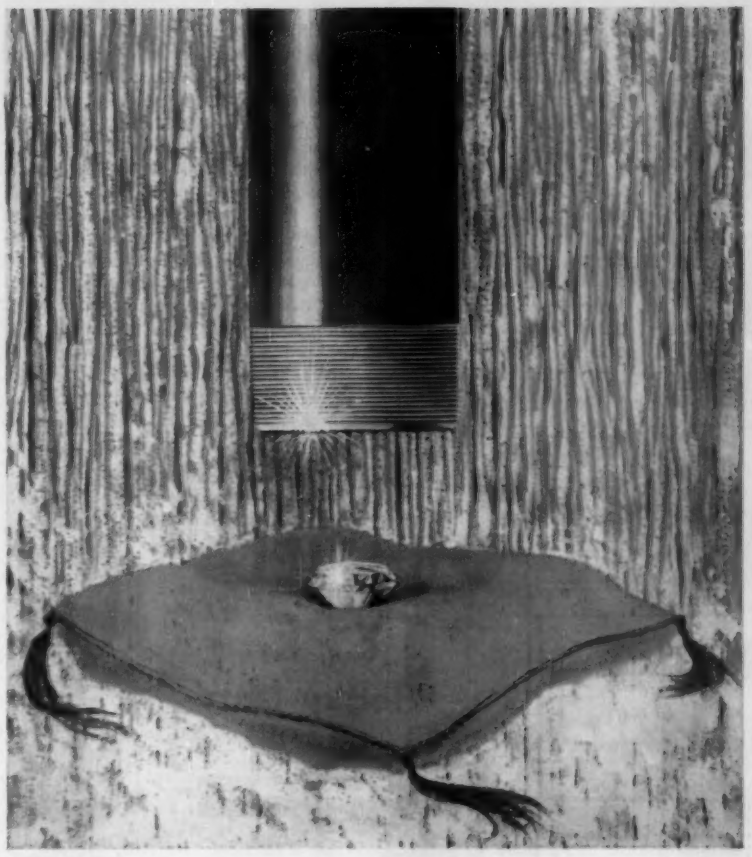
Nine wells have been completed in another field using a pozzolan-cement mixture containing gilsonite in concentrations of from 25 to 30 lb. per sack of the pozzolan-cement blend. Nearly every well in this field is completed in two producing zones, which are broken or fractured limestone embedded in fairly thick, rotten-shale sections. Lost returns have not been as great a problem in setting the production string as has been communication between zones caused by channeling of the cement. Consequently, every well had to be block-squeezed to isolate the pay zones for fracturing and acidizing.

Because of the scouring action of gilsonite in the cement slurry, it appears to be helping remove the filter cake in the annulus during cementing. Nine wells have been completed in this field using gilsonite cement and each has been successful in that no block squeezing was required either before or after fracturing and acidizing.

Fifteen squeeze jobs were unsuccessful on another well using many types of cementing slurries in an attempt to seal off the perforations. It was desired that the perforations hold a standing pressure of 3,000 psi. after drilling out.

When the well was squeezed using a gilsonite slurry, the perforations held a standing pressure of 2,500 psi. after drilling out; however, it failed to hold a pressure of 3,000 psi. Another squeeze job was performed successfully against the existing gilsonite cement with a standing pressure of 3,000 psi. being attained. Although this gilsonite-cement squeeze job itself did not hold the desired pressure it did provide strength and bridging action for a second squeeze job to be successful.

Some rules of use . . . Field results



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The jeweler, in showing a fine stone, often displays it on a velvet cushion so that its true brilliance and beauty of cut will be most apparent to the viewer.

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on over 100 primary-cementing jobs indicate that 25 to 50 lb. of gilsonite per sack of cementitious material will generally be optimum for controlling lost-circulation zones. Where weak formations exist, the bridging properties of gilsonite allow use of 12.5 to 13.5-lb. per gal. slurry weights for excellent results whereas other types of slurries have not been satisfactory even at much lower weights.

Because of its excellent bridging properties, certain precautions should be taken when using gilsonite cement. It does have a low specific gravity and may float and accumulate in a slurry of low viscosity. So, water should not be used ahead of the slurry because of potential dilution and viscosity reduction. The preferred fluid ahead of gilsonite would be a mixture of bentonite and water (300 lb. per 15 bbl..) The slurry should also be mixed at the recommended weight throughout the job.

In most areas, gilsonite appears to have a scouring action which is very good in removing drilling fluid and filter cake from the hole. Result is a better cementing job without necessity of block squeezing. Because of the scouring action of gilsonite in mud removal and because of the possibility of premature bridging, a bottom-cementing plug should not be necessary. The use of wall-cleaning devices should be held to a minimum to reduce possible restrictions in the annulus. **This is not intended to imply that wall scratchers are unnecessary nor that they must be removed to allow circulation of gilsonite. Gilsonite has been pumped without complication into annuli containing scratchers, and this is primarily a warning against too-close spacing of these devices over exceptionally long intervals of pipe.**

The only precaution regarding other cement additives is to minimize the use of high-water-ratio additives which may materially reduce the strength and durability of the gilsonite blends. Accelerators, retarders, and low-water-loss additives can and should be used when specific well conditions warrant them.

References

1. Scott, P. P., Jr., and Lummus, J. L.: "New Developments in the Control of Lost Circulation," Petroleum Branch, AIME, Paper No. 516-G, 1955.
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3. Clark, E. H., Jr.: "You Can Reduce Lost-Circulation Problems," Part 1, OGJ, July 2 (1956); Part 2, OGJ, July 16 (1956).
4. API RP 10B: Recommended Practice for Testing Oil-Well Cements; seventh edition, Jan. 1958.
5. API RP 29: Recommended Practice on Standard Field Procedure for Testing Drilling fluids, fourth edition, May 1957.

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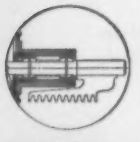

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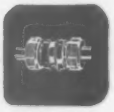

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- Canadian Refining Problems and Outlook
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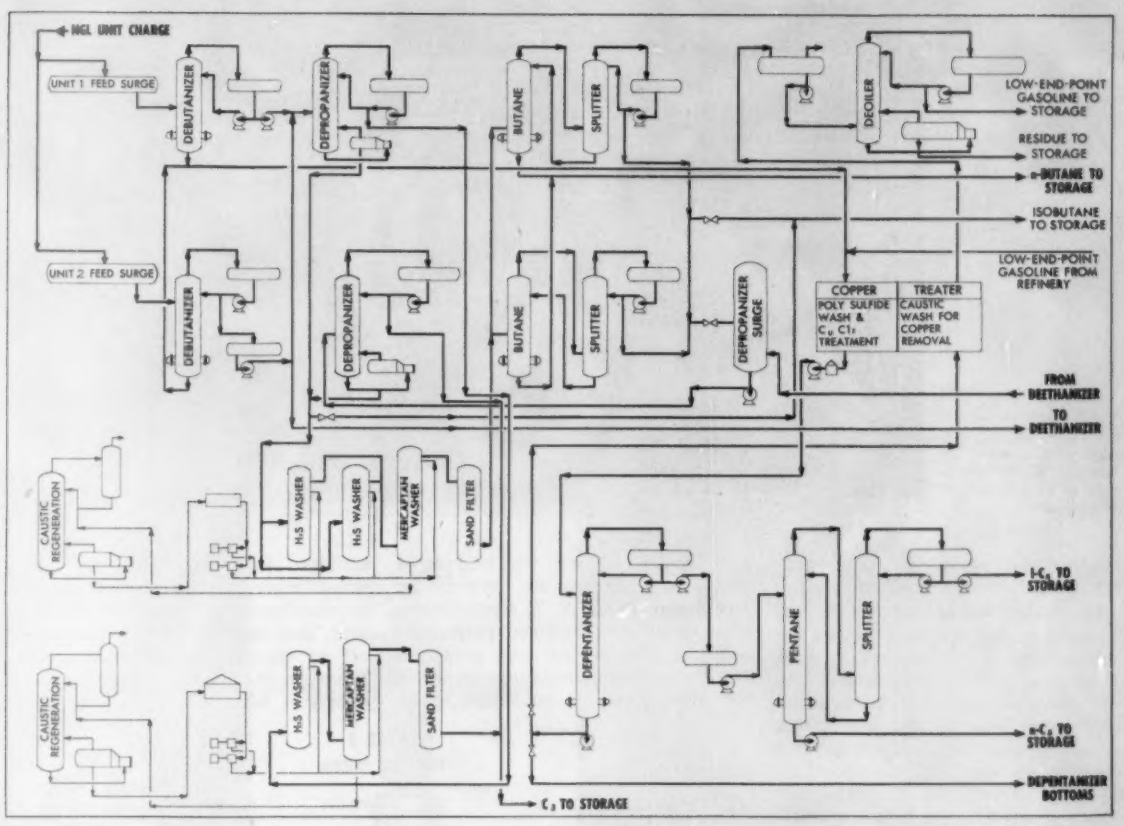
- LACT Grows in Canada.



TWO UNITS handle the natural-gas-liquids charge. Each unit includes a depropanizer, debutanizer, and butane splitter. A pentane-recovery system includes a dependanizer and pentane splitter.

Light-ends fractionating at Sweeny

How Phillips operates its 47,000-bbl. installation

BY LARRY RESEN
Refining Editor

EXTENSIVE light-ends-fractionating facilities are installed at Phillips Petroleum Co.'s Sweeny, Tex., refinery. Natural-gas-liquids fractionating units have the capacity to handle more than 47,000 bbl. daily.

Tied in with the main fractionating towers is a pentane section with a capacity of more than 20,000 bbl. per day. Debutanizer bottoms plus refinery low-end-point gasoline are processed in this second stage.

The high volumes handled make this plant Phillips' second-largest natural-gas-liquids installation, exceeded only by its Borger, Tex., operations. The high volumes processed make the equipment installed of special interest. Tower sizes are shown in Table 3.

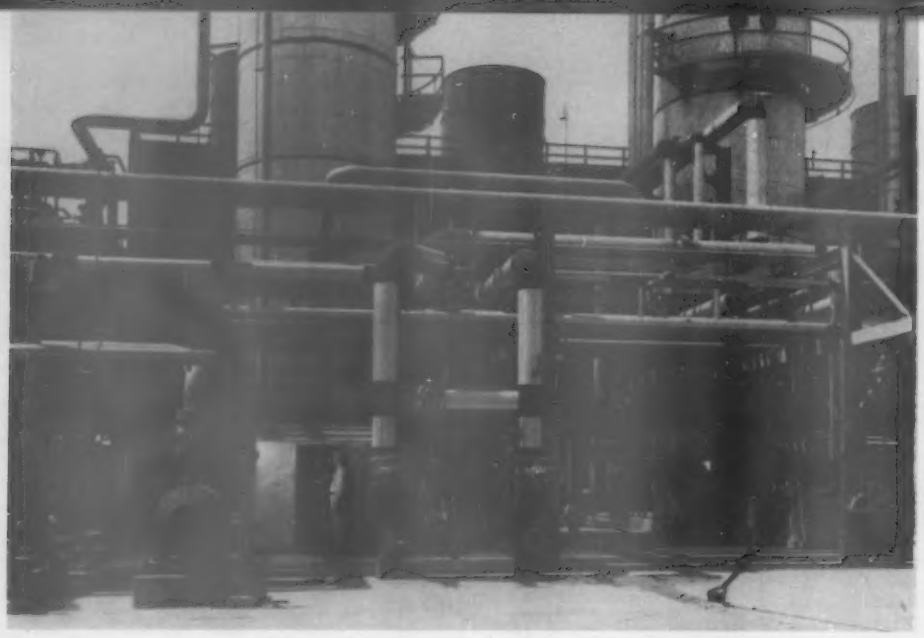
Two main sections . . . The two fractionating sections are essentially identical installations, including a depropanizer, debutanizer, and butane splitter. The main difference is in processing capacity as reflected in the depropanizer. Unit 1 has a 13-ft.-diameter depropanizer, and Unit 2 only a 7-ft. tower. The units are generally run in parallel.

The pentane-recovery system includes a dependanizer and pentane splitter. The butane splitters in Units 1 and 2 systems and the pentane splitter each consist of dual towers. The two 50-tray towers in each instance are connected bottom to top to function as a single tower.

The plant also includes a deoiler tower. This was included to handle heavy ends which came through with the natural-gas liquids when they were batched into the plant in a crude pipeline. Changing this pipeline to full-time natural-gas-liquids service has eliminated the need for the deoiler, and it is now used to split reforming-unit feed stock.

Typical charge analyses and yields are given in Table 1.

Flow pattern . . . The natural-gas-liquids feed is charged in parallel flow to the debutanizers, where the initial split is made. These towers are operated on continuous chromatographic control (M. M. Fourroux, OGJ, Apr. 21, 1958, p. 114). Differential refractometers are used for a stream analysis on the pentane section towers. These are generally for monitoring purposes; however, they can be used for control. Light ends from the debutanizer



INFRA RED analyzer, left foreground, has proved successful in improving the operations of the fractionating units.

are then depropanized in the next step in the fractionation train.

The mixed-butane bottoms pass through a caustic scrubbing system for removal of H_2S and mercaptans prior to entering the deisobutanizer. The unit contains regeneration facilities for caustic used in the mercaptan-scrubbing operation. A sand filter is used following the mercaptan removal tower, and the filtered stream is then charged to the butane splitter, with isobutane and n-butane going to storage. A separate caustic scrubbing setup is used for the propane make. It also includes its own caustic regeneration equipment for caustic used in the mercaptan scrubbing.

Bottoms from the debutanizers are copper treated prior to entering the pentane-recovery unit. The debutanized stream is first washed in a polysulfide solution to remove any free sulfur and H_2S. A sand filter is used to remove entrained polysulfide solution. The stream then goes into the dry copper chloride treaters where the mercaptans are converted to disulfides. Following this step, the stream enters the dependanizer. In the two-step operation, n-pentane, isopentane, and heavier streams are pulled off to storage. Typical charge and yields for the pentane section are presented in Table 2.

TABLE 3
TOWER SIZES

Tower	Diameter	No. Trays	Length (Tangent to Tangent)
	ft.		ft.
Debutanizer, Unit 1	13	50	112
Debutanizer, Unit 2	13	50	112
Depropanizer, Unit 1	13	50	108
Depropanizer, Unit 2	7	50	112
Butane splitter, Unit 1	13	*100	112
Butane splitter, Unit 2	13	*100	112
Dependanizer	13	50	112
Pentane splitter	13	*100	112
Deoiler	10	25	56

*Two 50-tray towers.

TYPICAL CHARGE TO FRACTIONATORS

Components	B/D	LV%
C_1	3	.01
C_2	578	1.22
C_3	15,805	33.41
iC_4	3,991	8.44
nC_4	11,545	24.40
iC_5	3,898	8.24
nC_5	4,226	8.93
C_6+	7,261	15.35
Total	47,307	100.00

TABLE 1
TYPICAL YIELD STREAMS FROM FRACTIONATORS

Components	Propane B/D	Propane LV%	Isobutane B/D	Isobutane LV%	N-Butane B/D	N-Butane LV%	D-C_4 Btms. B/D	D-C_4 Btms. LV%
C_1	3	.02	....	....	....	....	....	....
C_2	578	3.51	....	....	....	....	....	....
C_3	15,778	95.82	27	.69	....	....	....	....
iC_4	107	.65	3,834	97.38	50	.43	....	....
nC_4	....	....	76	1.93	11,451	99.46	18	.12
iC_5	....	....	....	....	13	.11	3,885	25.24
nC_5	....	....	....	....	....	....	4,226	27.46
C_6+	....	....	....	....	....	....	7,261	47.18
TOTAL	16,466	100.00	3,937	100.00	11,514	100.00	15,390	100.00

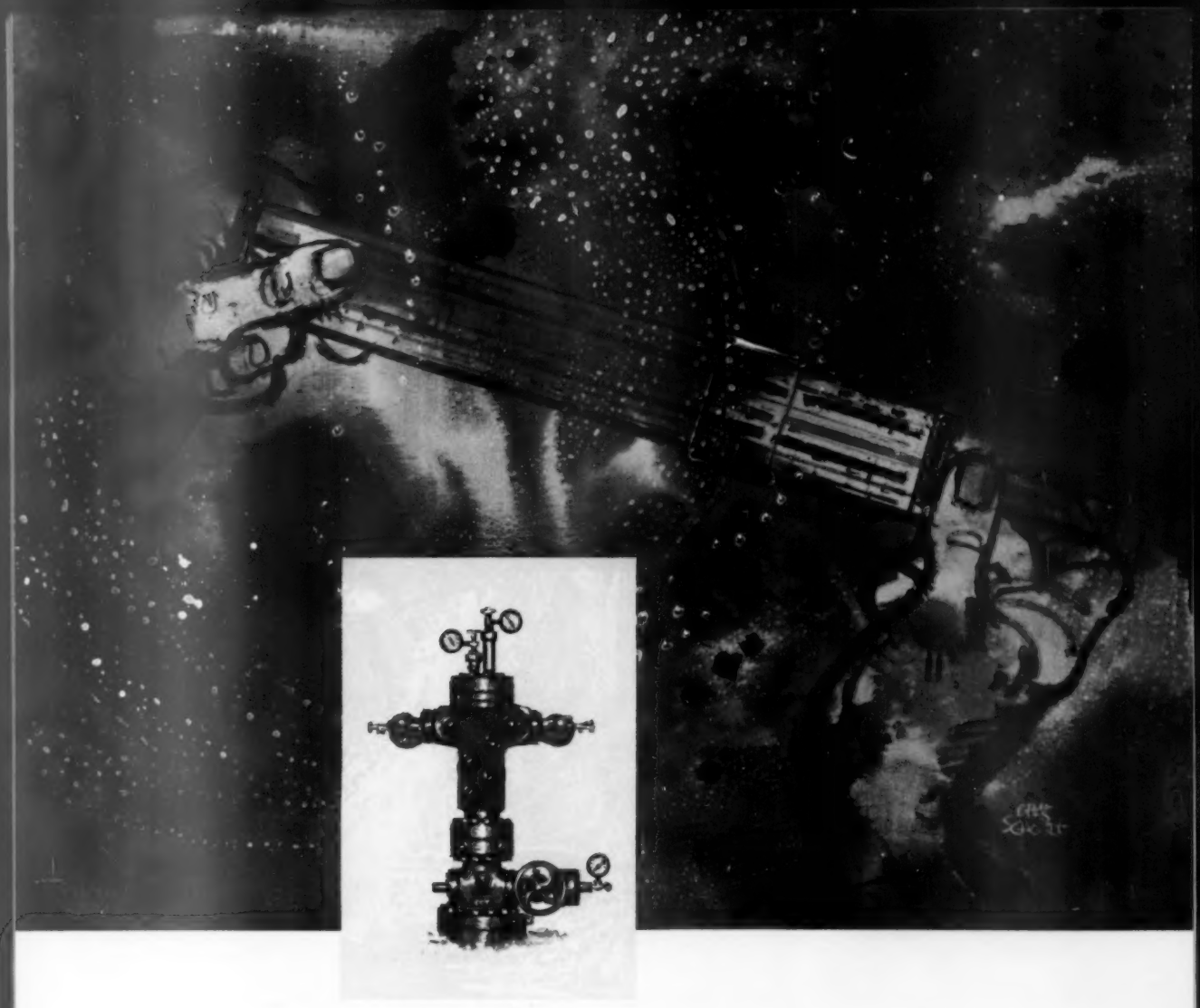
TYPICAL CHARGE TO PENTANE UNITS*

Components	B/D	LV%
nC_4	18	.09
iC_5	3,935	19.33
nC_5	3,947	19.39
Cyclo C_5	67	.33
C_6+	12,387	60.86
Total	20,354	100.00

TABLE 2
TYPICAL YIELD STREAMS FROM PENTANE UNITS

Components	Isopentane B/D	Isopentane LV%	N-Pentane B/D	N-Pentane LV%	Deoiler Ovhd. B/D	Deoiler Ovhd. LV%	Deoiler Btms. B/D	Deoiler Btms. LV%
nC_4	18	.47	....	....	....	....	....	....
iC_5	3,811	98.86	124	3.01	....	....	....	....
nC_5	26	.67	3,921	95.36	....	....	....	....
Cyclo C_5	....	....	67	1.63	....	....	....	....
C_6+	....	....	....	....	11,422	100.00	965	100.00
TOTAL	3,855	100.00	4,112	100.00	11,422	100.00	965	100.00

*Debutanizer bottoms from main fractionating sections, plus refinery low-end-point gasoline.



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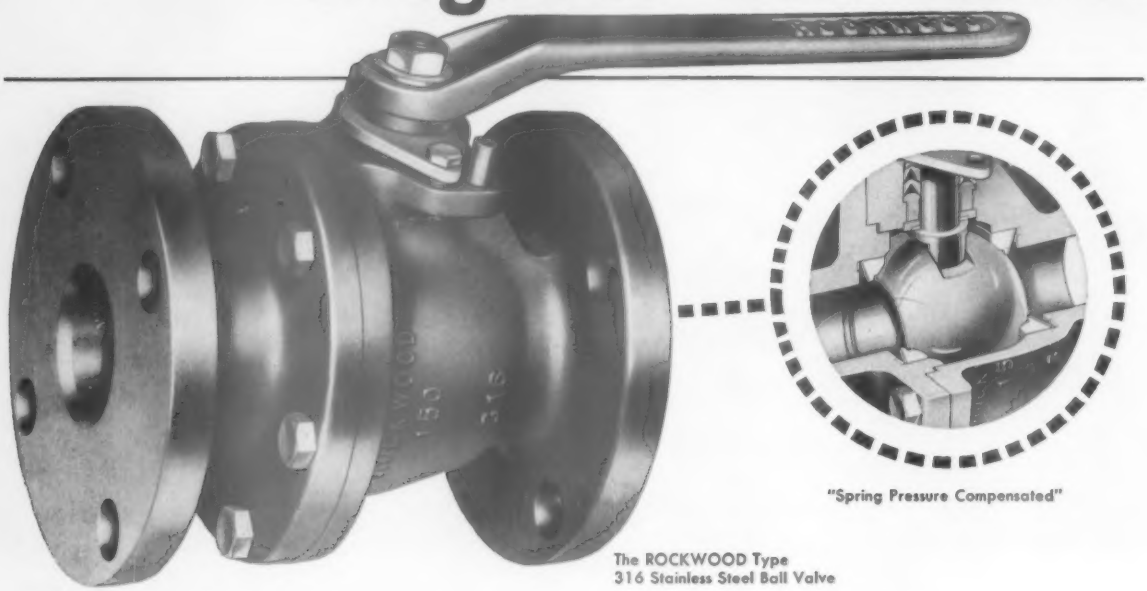

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13. How to determine effective permeability

(c) From pressure-buildup data under infinite boundary conditions.

BY E. T. GUERRERO
Head, Department of Petroleum Production Engineering, University of Tulsa,
and
F. M. STEWART
Petroleum Engineer, Continental Illinois National Bank & Trust Co., Chicago

GIVEN: The following data are typical of pressure buildup in a well for an average reservoir where infinite boundary conditions (this prevails early in the life of every reservoir) can be assumed to prevail:

Shut-in time, hours Θ	Sand-face pressure, psi., p_w
2	1,375
3	1,400
4	1,435
5	1,465
7	1,515
8	1,527
10	1,540
12	1,548
19	1,555
24	1,558
36	1,562
60	1,567
94	1,572
150	1,575

Other Data

t, days on production from initial completion = 10.

Q_o, average production rate of stock-tank oil = 125 bbl./day.

μ_o, viscosity of oil at reservoir conditions = 0.8 cp.

h, net sand thickness = 15 ft.

r_w, radius of well = 4 in.

c_o, compressibility of oil at reservoir conditions = 1.5×10^{-5} vol./vol./psi.

ϕ, porosity = 25%.

β_o, oil formation-volume factor = 1.25.

FIND: 1. From a plot of p_w vs. log Θ, the three major portions of the curve: (a) the afterflow period; (b) the proper buildup portion, and (c) near static conditions.

2. Reservoir pressure.

3. Average effective permeability to oil.

METHOD OF SOLUTION: Early in the life of a reservoir the pressure at the sand face (p_w) for Θ time after shut-in is given by the equation

$$p_w = p_o - \frac{162.6\, Q_o \mu_o}{\beta_o k_o h} \log \frac{t+\Theta}{\Theta} \quad (1)$$

During a pressure-buildup test p_o, Q_o, μ_o, β_o, k_o, h and t of Equation 1 remain essentially constant. Consequently, this is the equation of the straight line obtained by plotting

$$p_w \text{ vs. } \log \frac{t+\Theta}{\Theta}.$$

Furthermore, p_o will be the ordinate intercept and the slope will equal

$$m = \frac{162.5\, Q_o \mu_o}{\beta_o k_o h} \quad (2)$$

In this equation Q_o, μ_o, β_o, and h are known and m can be determined from the proper buildup portion of the pressure-buildup curve. Thus Equation 2 can be solved for effective permeability.

SOLUTION:

1. Fig. 1 is a plot of Θ vs. p_w show-

$$m = \frac{p_{w2} - p_{w1}}{\log \left(\frac{t+\Theta}{\Theta}\right)_2 - \log \left(\frac{t+\Theta}{\Theta}\right)_1} \quad (1a)$$

Where:

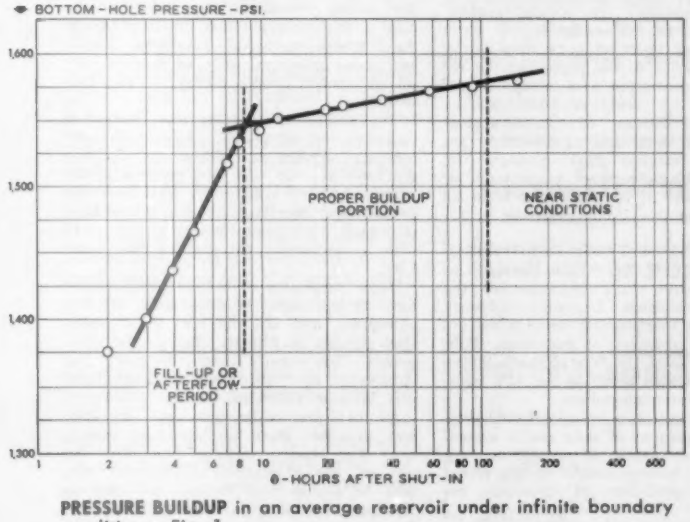
m = slope

p_w = pressure at the sandface for Θ time after shut-in, psi.

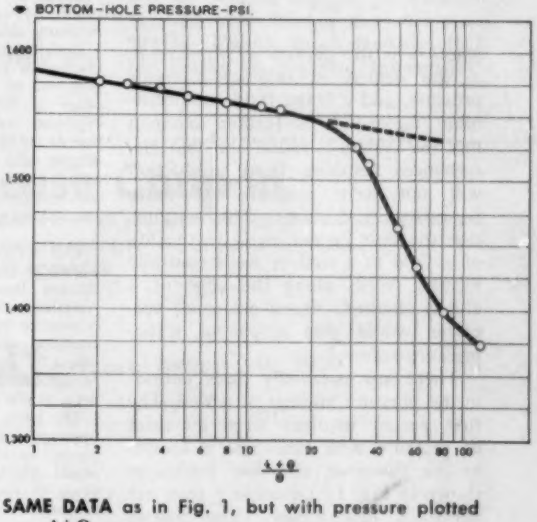
p_o = initial reservoir pressure, psi.

k_o = effective permeability to oil, md.

Θ = time well has been shut in, hours



PRESSURE BUILDUP in an average reservoir under infinite boundary conditions. Fig. 1.



SAME DATA as in Fig. 1, but with pressure plotted vs. $\frac{t+\Theta}{\Theta}$. Fig. 2.

ing the afterflow period, proper buildup portion, and near-static conditions.

2. An analysis of Equation 1 shows that if Θ is allowed to get very large, p_w will equal p_o. Therefore, extrapolation of the proper buildup portion of the pressure-buildup curve to

$$\log\left(\frac{t+\Theta}{\Theta}\right) = 0$$

(Fig. 2) shows that reservoir pressure, $p_o = 1{,}585$ psi.

3. According to Equation 2,

$$k_o = \frac{(162.6)\,(125)\,(0.8)}{(1.25)\,(m)\,(15)}$$

And, from Fig. 2,

$$m = \frac{1{,}585 - 1{,}557}{\log 10 - \log 1} = \frac{28}{1-0} = 28$$

Then

$$k_o = \frac{(162.6)\,(125)\,(0.8)}{(1.25)\,(28)\,(15)} = 31 \text{ md.}$$

DISCUSSION:

Equation 1 is obtained from the diffusivity equation using the point-source solution. Assumptions involved in the development are that the reservoir is homogeneous, horizontal, and of uniform thickness; fluid obeys Darcy's law and is present in one phase only; fluid compressibility and viscosity remain essentially constant over the range of temperature and pressure variation encountered; and the fluid density obeys the exponential-type law,

$$\rho = \rho_o\, e^{-c\,(p_o - p)}$$

where ρ is the density at pressure p, ρ_o the density at original reservoir pressure, and c is the fluid compressibility factor.[1] It is further assumed that the system is radial and that disturbances resulting from production will not have reached the outer boundary of drainage. This requires that the tests be run early in the life of a field in a well or wells centrally located. Wells along the edge of a closed (faulted, shaled-out, etc.) reservoir would give erroneous static-pressure values.[2]

There are essentially three periods in the pressure buildup of a well. The first period involves large increases of pressure with time and is known as the fillup or afterflow period as shown in Fig. 1. Equation 1 does not apply in this region. The proper buildup period follows the afterflow period after the casing has filled with oil. After a well has been shut in for a long time (100 to 200 hours or more), the static reservoir pressure is approached.

Fig. 2 shows the pressure-buildup curve plotted in a manner convenient for analysis and interpretation. Thus according to Equation 1 for a value of $\frac{t+\Theta}{\Theta} = 1.0$, $p_w = p_o$ or the reservoir pressure can easily be obtained from the plot by extrapolating the buildup curve to an abcissa value of 1.0. For the permeability determination care must be taken to use only the proper buildup portion of the curve in obtaining the slope. For the infinite case the proper buildup and near-static portions of the curve have the same slope.

The permeability obtained in this case is the effective value at interstitial-water saturation and maximum oil saturation. Where the rock is wetted by water this permeability value is nearly equal to the absolute permeability. This test is of such a nature (compression of a slightly compressible liquid) that the permeability determined is but slightly affected by the condition of the sand face as long as it will transmit fluids. Consequently, the permeability obtained is representative of the sand away from the well bore and in the interwell area. Furthermore, the measurement involves a very large sample of reservoir rock. This method of permeability determination is believed to be representative and reliable.

Normally a buildup test is not made primarily for permeability determination but also for static reservoir pressure (in tight formations) or for evaluation of well-completion or workover operations. The latter will be covered in a later problem.

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1. Horner, D. R., "Pressure Buildup in Wells," Proceedings of the Third World Petroleum Congress (II), 1951, 503-531.

2. Matthews, C. S., Brons, F., Hazelbrock, P., "A Method for Determining of Average Pressure in a Bounded Reservoir," AIME Petroleum Transactions, Vol. 201, 1954.

BOOKS

COVERED WAGON GEOLOGIST. Charles N. Gould. Published by University of Oklahoma Press, Norman, Oklahoma. 281 pp. $4.

This autobiography of one of the nation's leading geologists is being published more than a decade after his death. It was first written in 1946, and returned to Gould for revisions. Gould died before he could make the revisions, and the manuscript remained unpublished until it was rediscovered recently and prepared for book form.

Gould's professional career spanned almost 60 years, and was distinguished for its pioneering accomplishments in the geology and paleontology of the Southwest. He was a scientist, teacher, consultant and public servant. In a covered wagon, in a buckboard, on foot, on horseback, and finally by automobile, he pursued geology in many areas of the southwest.

Looking back upon his more than half a century of service to the people of the region and his profession as a teacher of geology at the University of Oklahoma, as organizer and director of the Geological Survey of the state, and as consulting geologist and National Park geologist, he could justly claim to have participated in the development of his profession from its covered wagon days to its maturity.

EQUATIONS OF STATE FOR HYDROCARBONS, by W. A. Bruce (Jersey Production Research Co.), chairman of the American Petroleum Institute's advisory committee on fundamental research on occurrence and recovery of petroleum. Published by the API, 50 West Fiftieth Street, New York 20. 183 p. $7.80 for API members; $13.00 for nonmembers.

The book contains a review of the development of equations of state and is accompanied by a discussion of notable achievements which have occurred during recent years in the prediction of volumetric behavior.

Three chapters are devoted to the Benedict-Webb-Rubin equation of state and its application to pure hydrocarbons and hydrocarbon mixtures. Other subjects include mathematical procedures used in work on equations of state and computer techniques for calculation of thermodynamic properties of hydrocarbons.

This is the third volume in a series emanating from API research project 37. Former books in this series are "Thermodynamic Properties of the Lighter Paraffin Hydrocarbons and Nitrogen," and "Some Properties of the Lighter Hydrocarbons, Hydrogen Sulfide, and Carbon Dioxide." These two volumes are also available through API.

ADVENTURE IN OIL. By Henry Longhurst. Published by Sidgwick & Jackson, London. 286 pp. 21 shillings.

This is the story of an enterprise which the British Petroleum Co. began at the turn of the century with a few pioneers in the barren wastes of southwest Persia, and today produces, sells, or searches for oil in almost every country of the free world.

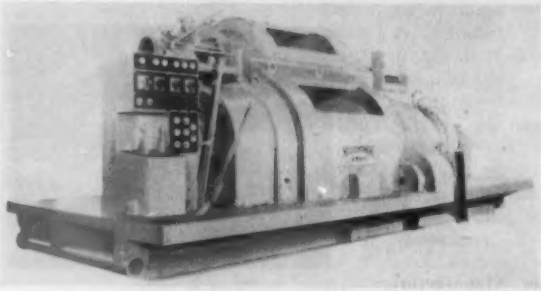
The author presents the story not of a company but of people. Alive today are men who marked out with scraps of calico the route for the very first pipeline in the Middle East or sailed in a boat over the water-logged island of Abadan, where later they built the biggest refinery in the world with a community the size of Salt Lake City.

Their successors in the last half-century have spread their business over all five continents, and sail the seas in a tanker fleet rivaling in tonnage that of the company's first really big customer, the Admiralty, in 1914, when its First Lord was Winston Churchill.

In his foreword to this book Sir Winston describes them as "merchant venturers." The reader, viewing them with the aid of Mr. Longhurst's observant eye, first in Britain and Persia, and then in Europe, Australia, Aden, Iraq, Kuwait, Papua, the Canadian Rockies, and Trinidad, may well conclude that they are engaged in no mean venture.

▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .



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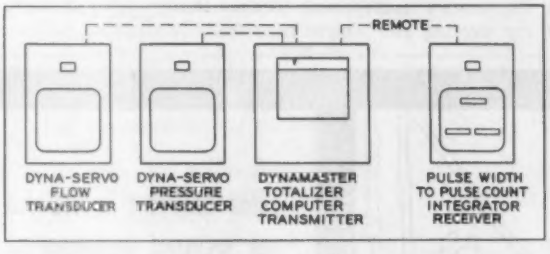
. . . and simplicity of small rigs yet it is rated at 900 to 1,400 net input hp. Operating controls on the U-914-C draw works are incorporated into a single console conveniently located to increase the driller's efficiency. Speed-selection levers and air-actuated clutch controls give the driller complete control of the rig.

Components of the packaged unit include hoisting drum, transmission, rotary drive, and auxiliary brake. All are on a single skid. Less auxiliary brake, the rig weighs 45,575 lb. and measures 10 ft. wide over-all. **Contact Manufacturer: Mid-Continent Supply Co., P. O. Box 189, Fort Worth, Tex., for details on U-914-C rig.**



New computing telemetering system

. . . is being produced for gas-distribution and pipeline applications. The system is designed for corrected flow measurement. The transducer is a null-balance type. A signal determined by the measured variable—temperature, flow, or pressure—is fed from an error detector to an amplifier. Amplified signal is fed to a servo motor that positions a servo shaft for operating a retransmitting slidewire, encoder, alarms, deviation contacts, and so on. Feed back cam on the servo shaft can be contoured to give exponential values.

The totalizing computing instrument includes down-scale fail safe and a transmitter. Manual adjustments are included for specific gravity and supercompressibility. The integrator coverts pulse-width signals from the transmitter to pulse count. Optional for the receiving station is a receiver for analog recording or digital read-out of corrected rate of flow. **Contact Manufacturer: Bristol Co., Waterbury 20, Conn., for details on gas pipeline computing telemetering system.**

Latest pipeline information system

. . . is engineered for accurately measuring, transmitting, indicating, and recording flow, pressure, temperature, and other pipeline variables in digital form. Variables are measured at remote points. Data is relayed by conventional communication or telemetering equipment to a central control station where it is converted into digital form and recorded by automatic typewriter.

One analog-to-digital converter is used. It converts and displays telemetered data continuously in digital form at the central control station. Other features include continuous alarm monitoring with adjustable high-low set points. The equipment can be adjusted to indicate pipeline variables directly in pounds per square inch, degrees, revolutions per minute, barrels per minute, and so on. **Contact Manufacturer: Fischer & Porter Co., 241 Jacksonville Road, Hatboro, Pa., for details on Pipeline Information System.**

Send this Showcase Coupon

to the Manufacturer of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

Described in OIL AND GAS JOURNAL · Issue of August 10, 1959

NAME.....TITLE.....

COMPANY.....

ADDRESS.....

CITY.....STATE.....

Gas engine rated at 4,000 hp.

. . . has been developed to provide a compact high-horsepower driver for centrifugal compressors in pipeline booster stations, for power generation, and for pump drive. The Model TPV engine is in turbocharged two-cycle gas V-type. Bore and stroke: 17 by 19 in. The engine has 10 cylinders.

Two other larger versions will be available too, rated at 4,800 and 6,400 b.hp. with 12 and 16 cylinders, respectively. The maker says the engine will operate at a thermal efficiency of about 40%. Other features cited for the engine include 77% more horsepower per square foot of floor space, and a b.m.e.p. rating of 110 psi. **Contact Manufacturer: Clark Bros. Co., Olean, N. Y., for details on TPV engine.**

●

Off-road hauler moves 30 tons

. . . of pipeline and oil-field equipment over desert and rough terrain. Propulsion is achieved by an electric motor at each wheel that is geared directly to the rim. A diesel-driven generator under the hood furnishes electrical power to the motors and to the motors used for steering and other purposes. **Contact Manufacturer: R. G. LeTourneau, Inc., 2399 South MacArthur, Longview, Tex., for details on off-road hauler.**

●

No manifold needed with meter

. . . recently brought out for installation in horizontal pipelines. Also 45° ells are not needed. Thus, these features cut down the number of connections needed, make the meter more compact, and simplify installation. The 2S meter was designed for LACT systems. But other potential uses are expected.

Liquid moves through the meter in a direct rotary path. Minute clearances between the revolving measurement parts and the chamber wall are

CROSE EQUIPMENT IS DESIGNED FOR OPERATING FLEXIBILITY — ANYWHERE!

The fact that the Crose coating and wrapping machine will wrap "egg-shaped" or out-of-round pipe is typical of how all Crose equipment is designed for maximum operating efficiency under unusual and difficult conditions. If you have a problem, call Crose today!

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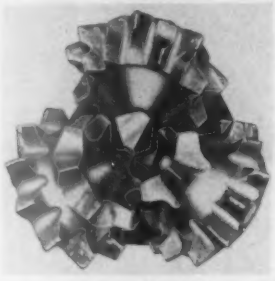
MANUFACTURING COMPANY, INC.

2765 Dawson Road • Phone WEbster 6-2171 • Tulsa, Oklahoma • BRANCH OFFICES: Houston • Denver • Los Angeles • Elizabeth, N. J. • IN CANADA: Crose-Curran Ltd., Edmonton, Alberta • EXPORT OFFICE: New York, N. Y.

sealed by a liquid capillary seal. Measuring vanes and rotor revolve on hard-carbon bearings. A microadjustment varies the speed ratio between the meter and the register, and a Teflon shaft seal protects the register drive and register.

Capacity of the meter ranges from 20 to 100 g.p.m. Working pressure is 300 psi. with a Series 30 flange and 215 psi. with a Series 15 flange. **Contact Manufacturer: Rockwell Mfg. Co., Meter and Valve Div., 400 North Lexington Avenue, Pittsburgh 8, for details on 2S meter.**

●



Drill bit for fast penetration

. . . in soft strata and in hard layers which often require several round trips if drag bits are used has just become available. The W3SC bit penetrates soft formations to 150 ft. or more an hour due to the widely spaced teeth and the ventilated jet action which overcome balling up, the maker claims.

Because of its gouging, twisting action, this design promises to be ideal for maximum footages in soft shales, clay, broken shale, salt, shells, and soft limestone. **Contact Manufacturer: Oil Tool Mfg. Co., Inc., P. O. Box 24, Tonkawa, Okla., for details on W3SC bit.**

●

Automatic backwash programer

. . . just made available is engineered to remove the human error in backwashing filters. The BFP-100 programer promises a way to save water, power, and labor.

An electrical type of control, it is actuated by a differential-pressure switch that senses the difference in pressure across the filter bed. It can be operated automatically or manually, handling up to 10 filters. The length of backwash is readily changed by changing the programer timer. Operating on 110-volt a.c., 60-cycle power, the instrument comes in a weatherproof and dusttight housing for wall mounting. **Contact Manufacturer: National Tank Co., P. O. Box 1710, Tulsa, for details on BFP-100 programer.**

Pressure gage aids drilling

. . . and is designed to remain accurate at all times. The new Ezy-Vue gage can be installed on the standpipe where it enables the driller to read pressures quickly and accurately by pointer position alone, regardless of the distance he is from the gage. It can also be installed on a blowout preventer to give an accurate reading of pressures. Other uses include indication of pressures in cementing, fracturing, acidizing, and gravel-packing.

Also available to aid in drilling is a new electric recording system. It is built to give a complete and perma-

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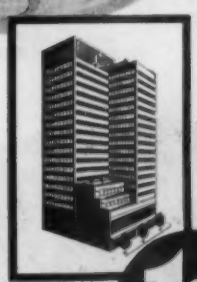
SINCE THE DAYS
OF THE BEAVER HAT

For nearly 65 years, First National has been serving the oil industry in its worldwide activities. To oil men, First National is truly "First in Oil in the Oil Capital".



Think... 1st of Tulsa

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MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION
SINCE 1895

nent record of the day's drilling operations. Data are presented in a manner that is neat, accurate, and easily interpreted.

The recorders, called Drilloger, are equipped with one, two, or four channels. Each channel can be used to record any of the following functions: total hook load and weight on bit, pump pressure, pump speed or volume, rotary speed, rotary torque, tong torque, rate of penetration, line or wellhead pressure, any pressure signal up to 15,000 psi., or any r.p.m. up to 3,000. **Contact Manufacturer: Martin-Decker Corp., 3431 Cherry Avenue, Long Beach 7, Calif., for details on Ezy-Vue pressure gage and Drilloger recorder.**

●

Oil-emulsion treating compound

. . . just recently made available offers a number of advantages, the maker reports, as a result of long-time testing in several oil-producing areas. It has been found to successfully treat different types of emulsified conditions in all areas tested. Tests also indicate that treating temperatures can be reduced, thus reducing vapor loss and conserving the oil gravity. Too, cleaner oil can be obtained and tank bottoms will be minimized, as compared to present methods.

Called BrakeSol D-7, the compound is compatible with the manufacturer's paraffin-treating chemical. By mixing the two chemicals in one chemical pump, both emulsion and paraffin conditions can be controlled throughout the system. **Contact Manufacturer: BrakeSol, Inc., P. O. Box 9506, Oklahoma City, for details on D-7.**

●

Handy oil-level switch-gage

. . . gives a visible oil-level check while equipment is running. This recent development offers a way to save time by not having to shut down an engine to check the oil level.

The switch is easy to install on either single or multicylinder engines. It comes combined with a safety shutdown or with an alarm for use on crankcase, pump gear case, or oil reservoir. **Contact Manufacturer: Frank W. Murphy Mfgr., Inc., Ranch Acres Station, Tulsa, for Bulletin L-5937.**

●

Portable electric centrifuge

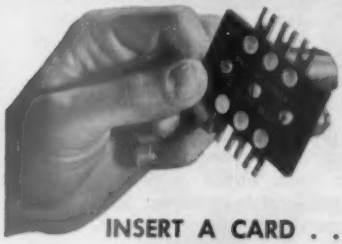
. . . just developed gives evidence of many new advantages. A long electrical cord with adapter permits the centrifuge to be plugged into the cigarette-lighter socket in a vehicle. The machine can then be placed on a location where there is enough room for the spinner head to revolve. The machine is also equipped with a three-

Water can't harm R&M "All Weather 40" Oil Country Motors!

Robbins & Myers Oil Country Motors are fully protected in all kinds of weather because moisture is locked out. R&M "weatherizing" includes: steel parts undercoated with a rust-resistant . . . iron parts treated with anti-corrosion primer . . . windings twice varnish-dipped and baked. Terminal box is gasketed . . . power leads sealed at shell. Baffles lock out wind-driven rain. Rodent screens are factory-installed. Yet you pay no extra for these dependable R&M 40° heat rise motors! Write today for Bulletin 520-OG

ROBBINS & MYERS, INC.
MOTOR DIVISION • SPRINGFIELD, OHIO

Great things are happening in AutroniC® Control



INSERT A CARD . . .
CHANGE THE RANGE

LOW-COST, HIGH-PERFORMANCE ELECTRONIC RESISTANCE THERMOMETER

Pick a temperature range between —50° and 700°F., or —50° and 350°C.; place the corresponding range card in the Swartwout thermometer adapter, and the temperature range is set up, ready to go.

Simple? You bet. Simplified design is the reason for the low price of the Swartwout Resistance Thermometer. It is also the reason for the unit's exceptional dependability.

Highly sensitive, the fully-electronic Swartwout Resistance Thermometer temperature system is adaptable to full-scale temperature spans as small as 3°F. It can indicate, record, or control. With slight modification, or auxiliary equipment, it will add, subtract or average temperature . . . even control the ratio between two temperatures, or between temperature and another variable.

All this is done with electronic speed. Data is transmitted instantaneously . . . no time-lag no matter where temperature elements are located.

The operational ease, functional flexibility and simplicity of the Resistance Thermometer are characteristic of the entire line of Swartwout AutroniC Instrumentation.

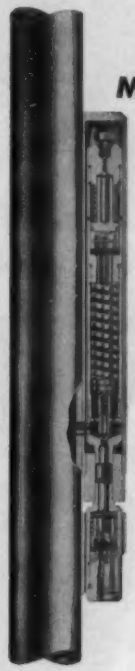
For details on the Resistance Thermometer, request Bulletin A-706-B. The Swartwout Co., 18511 Euclid Avenue, Cleveland 12, Ohio.

SWARTWOUT

. . . world leader in electronic process instrumentation

S.A. 1002

TIME TESTED MACCO GAS LIFT



CM2-FS

MACCO "SPRING" FLUID OPERATED VALVE

("No Charge" Bellows)

In this type valve, with no bellows charge, the spring tension is set as the valve opening pressure. The bellows functions only as a diaphragm, and the spring functions as the total actuating force. When once a valve opening pressure is set by spring tension, the pressure remains unchanged regardless of hydrostatic pressure or temperature applied to the valve in the well. Since the spring in this valve is the total actuating force, the valve may be set with either extremely low or high opening pressure (100-3000 psi). On the "SPRING" fluid operated valve, the spring tension keeps the valve closed until a desired predetermined head of fluid has entered the tubing.

Macco "Spring" Fluid Operated Valves are manufactured in two sizes. The CM2-FS Valve is 1½" diameter for all normal installations. The CM-1Fs Valve is 1" diameter and has wide application in dual, macaroni, and slim-hole lifting.

For further information regarding lifting with Macco Fluid Operated Valves, write for Brochure No. 3-12.

MACCO OIL TOOL COMPANY, INC.

1521 Prince P. O. Box 7288 Houston 8, Texas
Phone UN 1-1253

ATTENTION

SECONDARY RECOVERY ENGINEERS

Compute source water pumping costs, horsepower required . . . quickly and accurately

PEERLESS PUMP

(½ actual size)

PEERLESS CIRCULAR SLIDE RULE

NO CHARGE — BUT SUPPLY IS LIMITED

The new Peerless Circular Slide Rule permits fast, accurate figuring of horsepower required, and costs of operating source water pumps for secondary water flood projects. Using either gas engine or electric motor drive. Easy to use. One setting shows all figures.

Request your slide rule today.

PEERLESS PUMP DIVISION, FOOD MACHINERY AND CHEMICAL CORPORATION
301 West Avenue 26, Los Angeles 31, California

Please send me your Secondary Recovery Circular Slide Rule

Name_____
Title_____
Company_____
Address_____
City_____ State_____

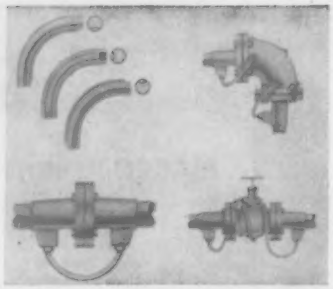
speed switch and pilot light for added convenience.

Since the centrifuge rests on rubber suction cups, the need to find a place to clamp it down is eliminated. For example, it can be operated on the fender or hood of a car or truck. **Contact Manufacturer: W. L. Walker Co., 1009 South Main, Tulsa, for details on electric portable centrifuge.**

●

Pipe with integral steam tracing

... is now being produced in sizes



with an outside diameter equal to 8-in. pipe. The larger sizes are being produced to meet the needs of handling such bulk material as fuel oil and asphalt.

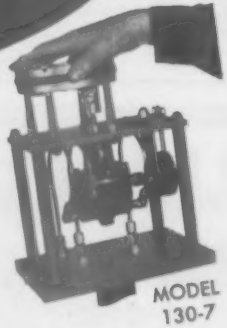
New fittings are also available for the Unitrace pipe. These include a flange, adapter flange, and 90° elbows. The flange allows simple and efficient joining of the pipe sections. The trace line is first cut back. Then the product line is inserted into the flange and welded at the neck and front face. Steam is led around a flanged joint by a jumper line threaded into a connection in each flange bottom.

The adapter flange permits the traced pipe to be joined to the bolt circles of jacketed valves and larger or smaller traced sections to be introduced into a system. **Contact Manufacturer: Aluminum Co. of America, 1501 Alcoa Building, Pittsburgh 19, for details on Unitrace.**

●

ARCCO

Arcco-Anubis CONTINUOUS GAS SAMPLER



MODEL 130-7

FOR OBTAINING REPRESENTATIVE GAS SAMPLES TO DETERMINE CHEMICAL AND PHYSICAL PROPERTIES OF GAS.

For obtaining more accurate gas sampling, this proven Arcco-Anubis instrument is unexcelled. It replaces older, inadequate methods for spot sampling. This sampler will over a period of seven days accumulate at a constant rate a sample of gas to a final pressure at or near 130 psig from a sample source, the minimum pressure of which is not less than 150 psig.

Models for many other pressure ranges and sampling periods now are available.

Send for Bulletin 112-R1.

Available for early delivery.

AMERICAN RECORDING CHART COMPANY

7142 East Condor Street, Los Angeles 22, California

AD NO. 101

Send for Bulletin 112-R1

Portable field X-ray equipment

... just made available makes a simple operation of X-raying tanks, pipes, and structures. The LX-140 X-ray unit weighs only 46½ lb. The control unit weighs only 25 lb. The complete unit is packaged in a shockproof case that measures 26 by 24 by 18 in.

The maker claims inexperienced personnel can learn to operate the machine in a few minutes. The machine offers a continuous range of 70 to 140 kvp. Radiographs with 2% sensitivity and 1.5 density can be produced with 1½-minute exposure through 1¼ in. steel. The X-ray machine will operate in temperatures from 0° to 120° F., humidity up to 95%, and altitudes to 5,000 ft., while providing effective radiation protection. **Contact Manufacturer: General Electric Co., X-ray Department, 4855 West Electric Avenue, Milwaukee, for details on LX-140 X-ray machine.**

Progress Report on Source Water Pumps for Secondary Recovery from

PEERLESS PUMPS

For Source Water. The Peerless Vertical Line shaft pump is adaptable to all type drives. In addition to the right angle gear drive pictured above, the pump may be ordered with a vertical hollow-shaft electric motor.

NOW GET UP TO 15,000 BPD FROM DEPTHS TO 1,500 FEET WITH PEERLESS VERTICAL LINE SHAFT PUMPS

Whether your source water is 150 feet or 1,500 feet deep, the Peerless vertical line shaft pump is the ideal pump for a steady dependable flood water supply. That's because it is big enough to do the job—up to 15,000 BPD from well depths to 1,500 feet; it is flexible enough to fit any water flood project; and it has been proved on the job over periods of up to five years of continuous flood water supply service.

Moreover, Peerless vertical line shaft pumps are specially built for the rigorous duty of handling corrosive fluids encountered in flooding operations. For example, the water lubricated type most frequently used for this service has special shaft bearings that are most resistant to the damages of abrasives and corrosives in the fluids being pumped.

And Peerless offers you a number of different models permitting the vertical line shaft pump to be tailored to your area and water flood conditions. An informative bulletin on these pumps is available to you upon request.

Write today and request your copy of Bulletin B-102.

For Injection Service. Peerless Hydro-Line pumps have capacities up to 175,000 BPD and pressures up to 1000 psi. Pumps are well suited to handle corrosive liquids, and by adding or removing stages pressure can be carried without loss of efficiency.

Putting Ideas to Work

fmc FOOD MACHINERY AND CHEMICAL CORPORATION

Peerless Pump Division

Offices:
New York; Detroit; Cleveland; Chicago; Indianapolis; St. Louis; San Francisco; Atlanta; Plainview; Lubbock; Phoenix; Albuquerque; Los Angeles; Fresno.

Distributors in principal cities.
Consult your telephone directory.

PEERLESS PUMP DIVISION, FOOD MACHINERY AND CHEMICAL CORPORATION
301 West Avenue 26, Los Angeles 31, California

Send me Bulletin B-102 ☐ Have a field engineer contact me ☐

Company_____

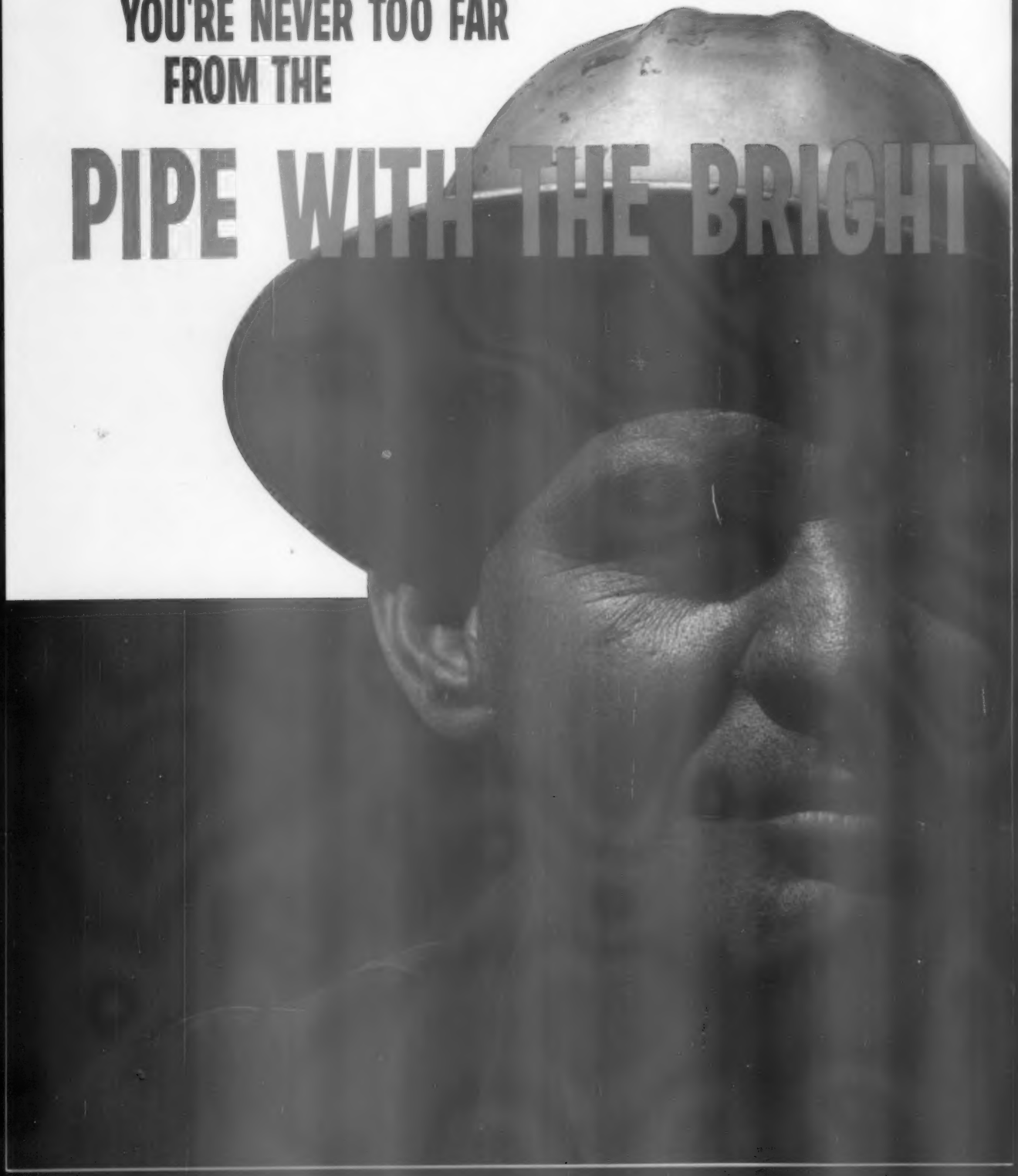
Name_____ TITLE

Address_____

City_____ State_____

WHEREVER
YOU ARE
YOU'RE NEVER TOO FAR
FROM THE

PIPE WITH THE BRIGHT



Throughout every active area in the oil patch, Orange Band Pipe Distributors have trained personnel and supply stores close to the point of use. It doesn't matter where you are — they will deliver the goods. The Youngstown Sheet and Tube Company, Youngstown 1, Ohio.

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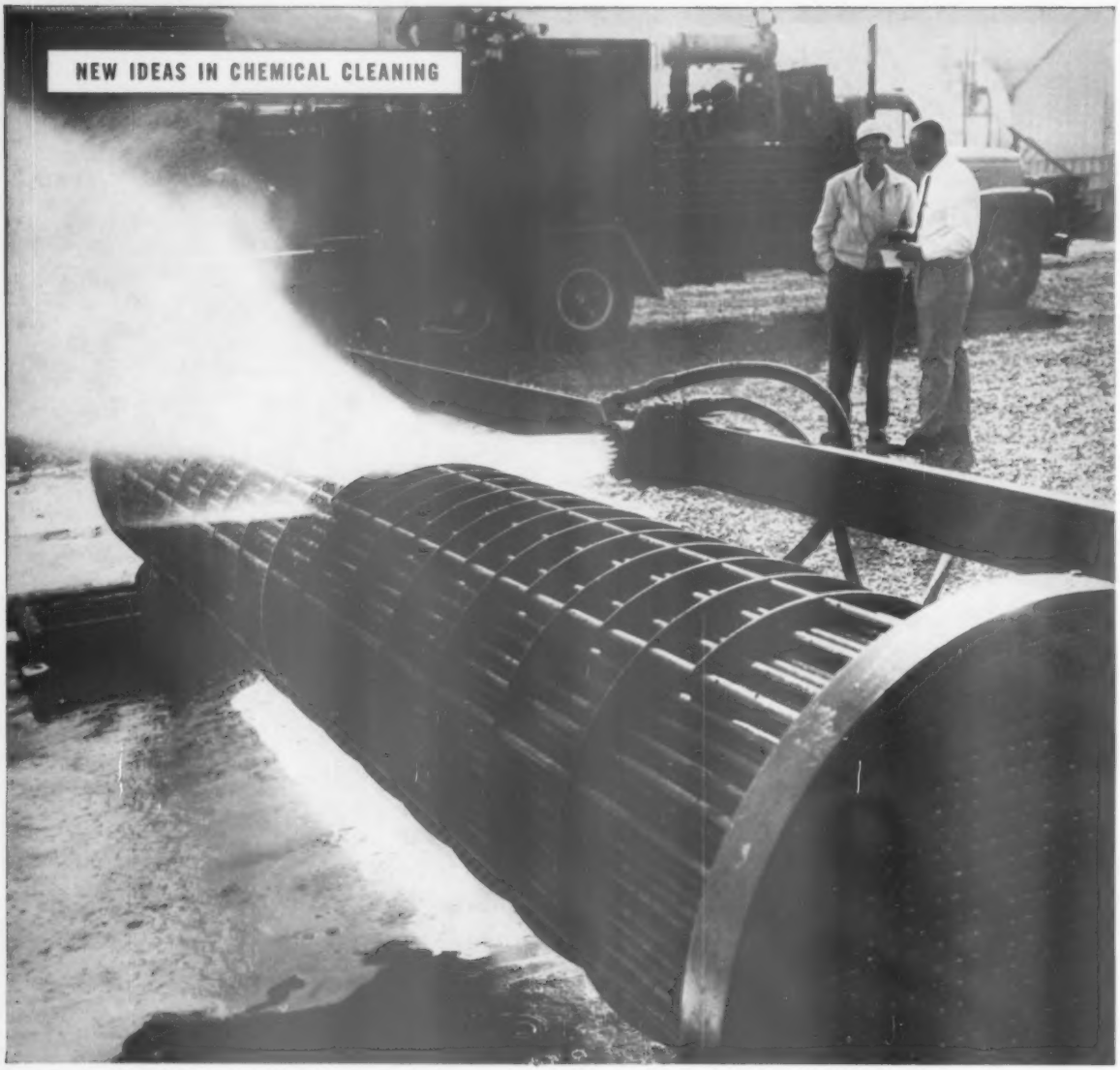


New Jetting Tool To Clean Tube Bundles Saves Thousands Of Dollars

The new high-pressure hydraulic tool, shown above, is currently saving thousands of dollars for companies in the refining, chemical, and petrochemical industries. It is the jetting tool developed by Dowell to remove deposits from heat exchanger tube bundles.

Previous methods of cleaning these bundles have been costly, time-consuming and often inadequate. Many times bundles had to be replaced completely because of the lack of a suitable cleaning method.

This new Dowell tool has a remarkable record of thorough, fast cleaning. For example, a slurry reboiler exchanger bundle, three feet in diameter and 16 feet long, was fouled with deposits of coke and asphalt. After being jetted from only one side, the bundle was thoroughly clean. Time required: less than one hour.

The tool holds the bundle in place for cleaning and has flanged rollers for rotation. The jet-head is manipulated automatically so that all tube spaces are covered. The jetted liquid can be either water or chemical solvents.

This high-velocity jetting device is another example of the new ideas Dowell continues to offer in chemical cleaning to help you cut your costs. Whatever the cleaning problem in your plant, call Dowell for an engineered recommendation. Dowell — the largest, the oldest, the most experienced chemical cleaning service — Tulsa 1, Oklahoma; and 165 stations and offices in major industrial centers.

Chemical cleaning service for all industry DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

SHOWCASE . . .

New Literature

Fire-fighting equipment brochure

. . . describes and illustrates various types of portable fire extinguishers, wheeled units, built-in carbon-dioxide extinguishing systems, and several types of fire-detection devices.

Sixteen-page Brochure P-49 discusses new designs of pressurized extinguishers, and includes a chart which shows extinguishers approved for use on each class of fire (ordinary combustibles, flammable liquids, and electrical equipment). **Contact Manufacturer: Walter Kidde & Co., Inc., Main Street, Belleville 9, N. J., for Brochure P-49.**

Booklet discusses pump selection

. . . and pump use in a new 12-page form. The free publication: (1) contains specific information on pressure and suction problems; (2) tells how to select the proper-size motor for various pumps and pumping applications; (3) lists typical jobs that can be performed; and (4) describes accessories commonly used in pumping installations. **Contact Manufacturer: Customer Service Dept., Hypro Engineering, Inc., 700 Thirty-ninth Avenue N. E., Minneapolis 21, for Choosing and Using Hypro Pumps booklet.**

Chemical-Loaded Molecular Sieves

. . . is the title of a new, available 12-page brochure. The literature discusses the sieves' ability to store chemicals to be displaced under conditions and at a time that can be controlled. For some time molecular sieves have been regarded as superior absorbents that give excellent performance.

The booklet: (1) explains how chemicals are stored in molecular sieves; (2) indicates various established uses of this ability and the sorts of chemicals that can be loaded; and (3) outlines a typical case history and shows how extremely volatile ditertiary butyl peroxide was loaded to advantage as a catalyst in the manufacture of vinyl-containing silicone rubber.

Finally the literature suggests, in general terms, other uses for the sieves, and includes a questionnaire through which additional data can be obtained. **Contact Manufacturer: Linde Co., Div. of Union Carbide**

This advertisement is neither an offer to sell, nor a solicitation of an offer to buy any of these Securities. The offering is made only by the Prospectus.

Not a New Issue **July 23, 1959**

200,000 Shares

Tuboscope Company

Common Stock

Price $13.00 per Share

Copies of the Prospectus may be obtained from such of the undersigned as are registered dealers in securities in this State.

Glore, Forgan & Co. **Rowles, Winston & Co.**

SALT WATER CORROSION
YOUR PROBLEM?
solve it with
DeZurik PLASTIC-COATED VALVES!

DeZurik Eccentric Valves can now be furnished with plastic coatings. The plastic coating greatly increases the corrosion resistance of a cast iron valve at only a slight increase in price.

DeZurik Plastic-Coated Valves are the economical answer for salt water disposal systems and other services where resistance to alkalies, mild acids and neutral salts is required. They are also particularly suited to applications where iron contamination is objectionable.

See the DeZurik representative near you, or write for details.

DeZURIK CORPORATION
SARTELL, MINNESOTA

Corp., 30 East Forty-second Street, New York City 17, for Chemical-Loaded Molecular Sieves brochure.

Hydraulic pumping unit

. . . called Hydrax, is described in a new literature piece, available upon request. The publication gives a product data sheet, production tables, photographs, and specifications on the $700, 24-in. unit. **Contact Manufacturer: Axelson Div., U. S. Industries, Inc., 6160 Boyle Avenue, Los Angeles 58, for Hydrax hydraulic pumping unit bulletin.**

Dry pulverizing of materials

. . . to micron-size powders is accomplished by Jet Pulverizers, as related in a new four-page bulletin. It graphically describes grinding, pulverizing, and processing actions of the pulverizers and notes that they now process materials so that they often display new physical characteristics—thus making them adaptable for use in many new applications.

Powered directly by compressed air or superheated steam, the pulverizers are available in eight custom-made sizes, with mill diameters from 2 to 36 in., according to the literature. **Contact Manufacturer: Jet Pulverizer Co., Route 73, Palmyra, N. J., for Jet Pulverizer bulletin.**

184-page floodlight catalog

. . . is a handy, pocket-size edition, available upon request. Catalog 2714 contains sections on: (1) how to select floodlights; (2) general-purpose floodlights; (3) heavy-duty floodlights; (4) mercury-vapor floodlights; (5) special floodlights; (6) lighting for hazardous locations; (7) searchlights; (8) underwater lighting; (9) floodlight poles; (10) accessories; (11) installation suggestions; and (12) lighting calculations. **Contact Manufacturer: Crouse-Hinds Co., Syracuse 1, N. Y., for Catalog 2714.**

Free tank-capacity calculator

. . . which is handy and simple to use, will enable you to tell in a moment the volume contained in a vertical vessel. The calculator is an invaluable aid in determining volume in bushels, gallons, and barrels of vessels ranging in height from 5 to 100 ft. **Contact Manufacturer: Solar Chicago, Div. of U. S. Industries, Inc., 6400 West Sixty-sixth Street, Chicago, for tank-capacity calculator.**

Aluminum spur-gear hoist

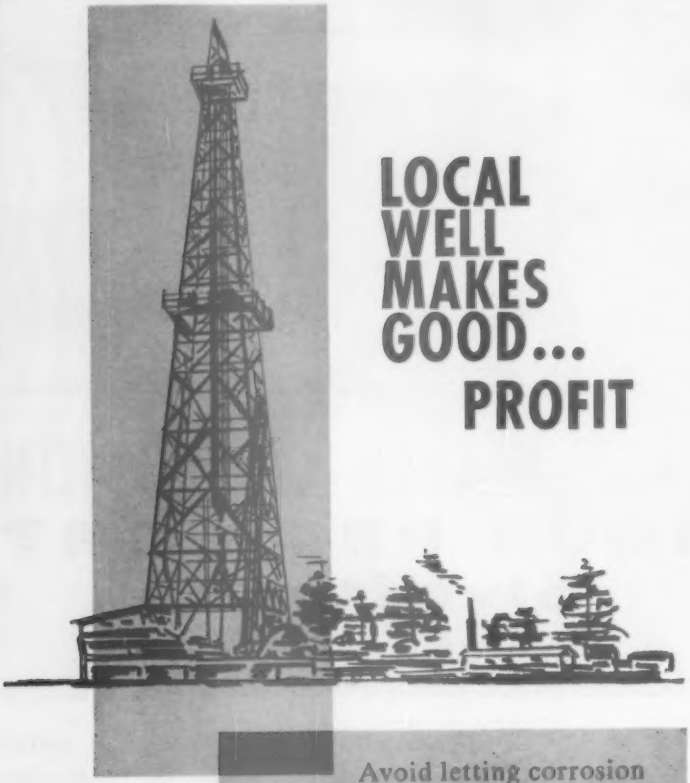
. . . is detailed in an obtainable, two-page publication which contains complete specifications on the model and its recommended trolley. Bulletin ADH-80 also gives specifications and data on the Model M-25 Midget chain hoist. **Contact Manufacturer: Coffing Hoist Div., Duff-Norton Co., Danville, Ill., for Bulletin ADH-80.**

Trace-gas analyzer

. . . designed for detection of contaminants in air or process streams in parts per billion, is described in a new four-page bulletin, now obtainable. The instrument's principle of operation, based on a method of gas analysis using continuous ionization from an alpha source, is fully outlined in Bulletin 0714-3.

Typical detectable contaminants include alkaline gases, nickel carbonyl, tetra-ethyl lead, sodium dioxide, halogenated hydrocarbons, and oxygen in nonelectro-negative process streams.

Operational and construction details of the Billion-Aire trace-gas analyzer are shown in a cross-section of a typical detector cell, schematic flow diagrams, and schematic wiring diagrams. **Contact Manufacturer: Mine Safety Appliances Co., 201 North Braddock Avenue, Pittsburgh 8, for Bulletin 0714-3.**



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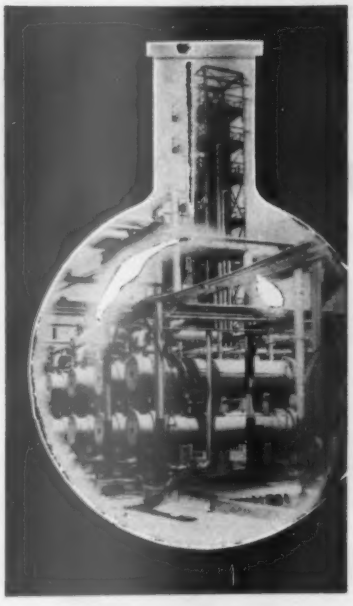

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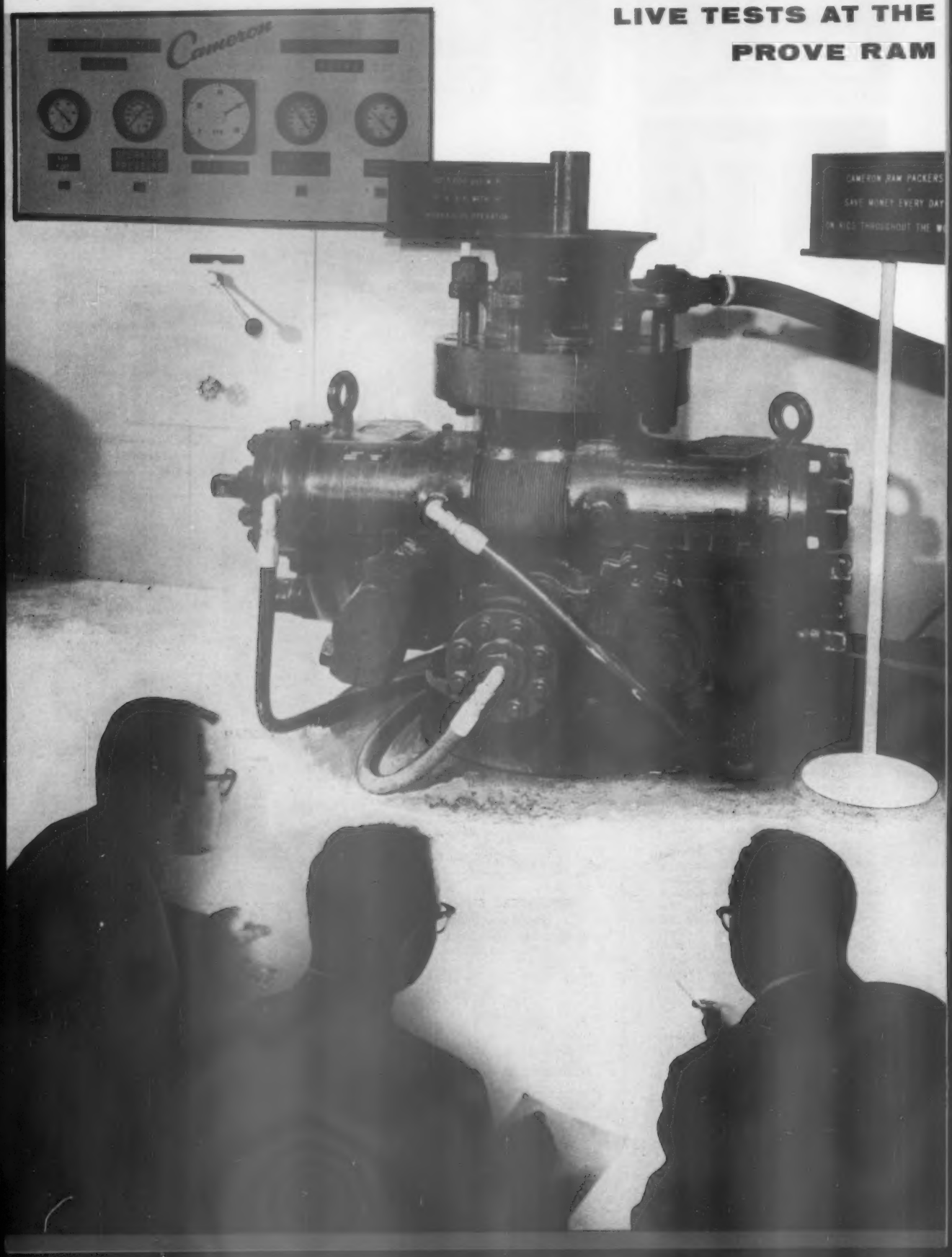
LIVE TESTS AT THE PROVE RAM



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PACKERS IN CAMERON PREVENTERS LAST LONGER

Just check the following results of one recent test made during a demonstration at the International Petroleum Exposition in Tulsa and witnessed by thousands of visitors.

TOTAL VERTICAL PIPE TRAVEL — 4,877'

TOTAL NUMBER PIPE REVOLUTIONS — 45,792

Well pressure — 2,000 PSI

— and only 60% of the feedable rubber reserve was used.

Drill pipe size — 3½"

Vertical velocity — 6' per minute

Rotating speed — 66 RPM

In Cameron's patented ram design the sealing rubber is always fully confined by steel.

BEFORE

AFTER

4,877 feet of 3½" drill pipe rotating at 66 RPM was run through this ram element while it held 2,000 PSI pressure — and only 60% of feedable rubber reserve was used.

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EQUIPMENT MEN ..... IN THE NEWS

William E. Scarborough named

W. E. Scarborough

... to the newly created position of domestic sales manager of Reed Roller Bit Co., reports President John Maher. Scarborough will head all Reed sales activities in the United States pertaining to Y-bits, tool joints, and drill collars. He will headquarter in Houston.

Scarborough was in Reed's engineering department for 20 years before leaving in 1956 to join Security Engineering Corp. as assistant chief engineer. He became Security's manager of quality control prior to rejoining Reed.

Russell L. Forsythe becomes

R. L. Forsythe

... manager of Schlumberger Well Surveying Corp.'s Pacific Coast area, replacing Fritz Taves who has retired. The announcement comes from W. J. Gillingham, president of Schlumberger.

Forsythe joined Schlumberger 22 years ago. Before that he was employed by General Electric, Ford Motor Co., Hanrahan Construction Co., and Paraffine Companies, Inc. Forsythe's past Schlumberger experience includes assistant area managership of Canada and a term as Kansas division manager.

Taves joined the firm in 1935. From 1922 to 1927 he was employed by Miley-Keck and E. J. Miley. Thereafter he worked for Richfield until 1929. He served in the California State Oil Umpire's office from 1929 until 1935.

Continental-Emsco announces

G. K. Ashmead

... the appointment of Gary K. Ashmead to district manager of a newly formed region comprised of Harvey, Houma, and Venice, La., field stores and a New Orleans city sales office. Ashmead will locate in New Orleans.

The new district manager joined C-E in 1950 and served as field salesman, store manager, credit representative, and sales representative. The company's South Louisiana division is under the direction of Manager E. A. Dunn.

Leopold A. Ffrench joins

... the Cooper-Bessemer International Corp. office at New York City, announces Charles G. Cooper, president of Cooper-Bessemer International. Ffrench will work directly under Cooper, and will devote his attention to the application and sale of engine-driven and motor-driven compressors for overseas installation.

Four managers are appointed

... by Oil Field Sales & Service, S. A., a subsidiary of U. S. Industries, Inc., in Maracaibo, Venezuela. Bill Richards, Richard Roman, and Mitch Breedlove have been made district managers, and Grady Rodgers takes over as general manager of wire-line service, according to Paul H. Koester, president of the South American firm.

Richards, new manager of the Western Venezuela district, joined Oil Field Sales & Service, S. A. in 1957, after working for Anzoategui Wire Line Service, Venezuelan Atlantic Refining Co., and the Bureau of Mines.

Roman, Eastern Venezuelan district manager, was employed by the firm last year. Previously, he was with

Bill Richards

Richard Roman

Garrett Oil Tools, Mene Grande Oil Co., and Celanese Corp. of America.

Breedlove assumes the title of manager of the Colombia district. He

Mitch Breedlove

Grady Rodgers

formerly was with Guiberson Mfg. Co. for 20 years as a machinist, engineer, and sales engineer.

Rodgers is the new general manager of Oilfield Wire Line Service, S. A., a subsidiary of Oil Field Sales & Service, S. A. Previously, he was general manager of sales and service, and a member of the board of directors of Associated Engineering & Equipment, Inc.

ORIGINAL PAINTING depicting the natural-gas industry is presented to the American Gas Association, headquartered in New York, by A. O. Smith Corp., Milwaukee. Making the presentation for A. O. Smith, at right, are S. E. Wolkenheim, vice president and director of marketing, and Walter Stake, regional vice president. Receiving the painting is C. S. Stackpole, managing director of the American Gas Association. At the extreme left is Harold Massey, managing director of the Gas Appliance Manufacturers' Association, who attended the ceremony. A. O. Smith used the painting in a national advertising campaign which emphasized that 750,000 shareholders own the national gas industry.

PESA accepts new member

Frontier Perforators, Inc., with headquarters in Pampa, Tex., has joined the Petroleum Equipment Suppliers Association. PESA is composed of firms engaged in petroleum equipment, supply, and service operations.

J&L Steel Corp. makes three

R. F. Derr

. . . changes affecting management personnel in the general sales office and tubular products division, according to John E. Timberlake, vice president in charge of sales.

Russell F. Derr, currently assistant general manager of sales assigned to the Detroit territory, will move to Pittsburgh to assume responsibilities. Edwin A. Booth, manager of tubular products, has been appointed assistant general manager of sales. Roger H. Martin, assistant manager of tubular products, is the new manager of tubular products.

E. A. Booth

R. H. Martin

Derr, who joined J&L as assistant general sales manager 2 years ago, formerly was Detroit district sales manager for Pittsburgh Steel Co., and before that spent 13 years with General Motors Corp.

Booth joined J&L as manager of tubular products in 1956, after serving 27 years with Spang-Chalfant Division of National Supply Co. in engineering and sales functions. His last post with National was as manager of tubular sales in the company's general office in Pittsburgh.

Prior to joining the corporation 16 years ago as a sales correspondent in the Chicago district sales office, Martin was with Joseph T. Ryerson and Hanafin Manufacturing companies in Chicago. In 1947 he was appointed a salesman in the Chicago office, and in 1951 was transferred to the Pittsburgh district sales office. Martin was named assistant manager of tubular products 6 years ago.

H. K. Porter Co., Inc. adds three

. . . to the firm's forge and fittings division, reports James H. Wyres, sales manager, and Jackson Kemper, general manager of the division.

A. A. Kascsak, Jr.

Albert A. Kascsak, Jr., has been appointed district manager of the Tulsa territory. He joined the division in 1957 and spent a year in the sales department. For the past year he has been the division's advertising manager. Prior to joining the company, Kascsak was a sales representative for Faitoute Iron & Steel Co. of Newark.

T. Bruce Cox, who comes to the division from Clayton Mark & Co., where he was manager of union sales, has been named new-product sales engineer. For 24 years, beginning with a position as salesman with Youngstown Sheet & Tube Co., Cox has been directly connected with the forged steel-union market.

Thomas H. Leggett, Jr., is the division's new advertising manager. He comes from Wallace & Tiernan, Inc., Bellville, N. J., where for 3½ years he held positions of development engineer and assistant advertising manager.

Herbert H. Hodgeman joins

. . . Daniel Orifice Fitting Co. as valve-design engineer, according to J. Virgil Moore, vice president of sales and engineering. Hodgeman formerly did consulting-engineer work in Houston, and has been with A-1 Bit & Tool Co. and the Houston Fortune Plant, both of Houston.

Harold W. Wahl named manager

. . . of American Meter Co.'s southwest division, announces President William G. Hamilton, Jr. For the past 9 years, Wahl has been manager of the southern division of Westcott & Greis, Inc., an American Meter subsidiary recently incorporated into the company's southwest division. He now makes his headquarters in Dallas.

H. W. Wahl

"SCOT" FORGED SEAMLESS RING GASKETS

MINIMUM HARDNESS

For ring Groove Flanges forged from reforging billets in the following materials in stock: Soft Iron, Copper, Aluminum, Inconel, Monel, Nickel; 1¼ Cr ½ Mo., 2¼ Cr 1 Mo., 9 Cr 1 Mo. 304, 310, 316, 321, 347, 405, 410, 430, 502, 304L, 316L, Nickel L.

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Many drillers are saving time by permanently attaching Simplex Screw Jacks to the underside of their rig floor. When the rig is to be moved, turnbuckle bracing is unfastened and jack is swung up, out of way. At new location, jack is swung down, turnbuckles attached and jack is ready to level rig. Jack can't get lost, is always available for use.

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Among the Drilling Contractors

An-Son's recently acquired elevated-deck barge slated for

Block 18 test in Eugene Island area

AN-SON Offshore Drilling Co., a subsidiary of An-Son Drilling Co., Oklahoma City, has purchased the "J. J. Stephens" drilling barge from Phillips Petroleum Co., Bartlesville, Okla. Carl B. Anderson, Jr., president of An-Son announced the acquisition.

Phillips has operated this equipment since it was built and commissioned at the Levingston Shipyards, Orange, Tex., in 1954. It is an elevated-deck barge, capable of drilling in protected waters up to 18 ft.

The drilling unit is comprised of: a National 125 draw works; three Fairbanks-Morse Model 38F90, 1,575-hp. engines; a 140 by 30 ft., 952,000-lb. derrick; and two Emsco D850 (8¼ by 18 in.) and one Ideal C350 (7¾ by 18 in.) slush pumps. Dimensions of the hull are 185 by 50 by 12 ft. The elevated deck is equipped with 6-ft. extensions with a 4-ft. sea wall around the main deck.

The air-conditioned quarters will accommodate 35 men. The new owners will put this rig to work for Shell Oil Co. in Block 18, off the coast of Louisiana.

Ex-Navy equipment set for drilling

OIL-DRILLING equipment purchased from the Navy at Point Barrow, Alaska, by Colorado Oil & Gas Corp., Denver, already is being dispersed to speed exploration of the vast sedimentary basins of Alaska, Colorado president W. C. Norman announced recently.

The surplus equipment, idle since 1953, included three large drilling rigs, 36,000 ft. of drill pipe, 29,800 ft. of well casing, 1,000 rock bits, and large quantities of spare parts and supplies. The competitive bid offer by Colorado for the equipment was approved by the Government this month. The replacement value of the equipment is in excess of $4 million.

Norman said one of the rigs, a National Ideal 125 capable of drilling to 15,000 ft., has been sold by his firm to a group of independent operators headed by Paul G. Benedum, Pittsburgh.

This equipment is being loaded now on barges at Point Barrow for shipment 1,100 miles through the Bering Strait and up the Yukon River to Nulato. This is in the Koyukuk basin of West Central Alaska where the Benedum group of 33 operators holds leases on 3½ million acres. The Benedum exploration well is projected to 12,000 ft.

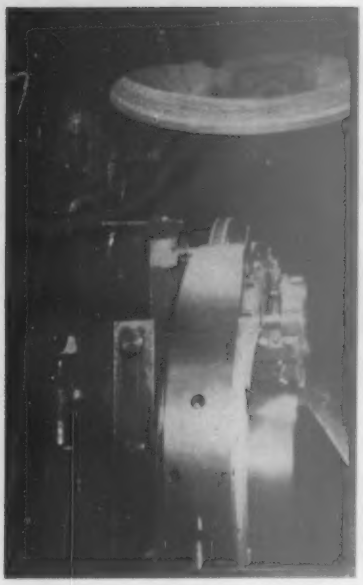
Colorado will use one of the rigs, a National Ideal 50 capable of drilling to 8,000 ft., for its own operations on the North Slope. The third

HCSmith 3-CUTTER ROCK BITS WITH THREADED FLOW NOZZLES

HCSmith OIL TOOL CO.

Branches in Principal Oil Centers Throughout the World

COMPTON, CALIF. • ODESSA • HOUSTON • DALLAS • OKLAHOMA CITY • GREAT BEND • EDMONTON



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The small engine crank pictured above was restored in close quarters without dismantling engine. Our portable machines can solve your problems and save you money. Crank pins from 5½" through 20" in diameter accurately refinished in place at great saving in cost. **Let us help you minimize down time.**

Worn and damaged flywheel fits refinished in place.

In our shop crankshafts of any size or type completely refinished. Shafts straightened and broken shafts successfully repaired.

Most modern methods used in rebabbitting and machining engine and turbine bearings.

All types of heavy power plant equipment serviced with special attention given to emergency repairs.

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rig, a Wilson 56 Super Titan, equipped for drilling to 15,000 ft., will be offered to other operators in Alaska, where exploration for oil is mounting rapidly.

The company recently acquired 90,000 acres of leases north of the Brooks Range in northern Alaska near the Naval Petroleum Reserve No. 4. Its leasehold includes 10,000 acres on a known gas-producing structure at Gubik, about 400 miles north of Fairbanks.

Full steam ahead

Barnes Core Drilling Co., Bakersfield, Calif., continues to keep busy (OGJ, June 29, 1959, p. 247) during the lull in California in oil-well drilling by drilling steam wells. A recent check showed two rigs drilling such wells in northern California. One was working for Thermal Power Co. on steam wells in the Geyserville area in Sonoma County. Barnes had completed eight 700-900-ft. wells for Thermal. In the northeast corner of the state near Alturas, Modoc County, Barnes had a rig drilling steam wells for Magma Power Co. This rig recently saw similar service in a search for steam in the Steamboat Springs area in neighboring Nevada.

Alaska-bound rig held by customs

MOUNTAIN States Drilling Co., Denver, is fast proving that it can overcome most any obstacle. After making carefully laid plans to meet a tight schedule in a complex operation (OGJ, April 13, 1959, p. 141) it was tripped up by government red tape.

Almost every factor, including such intangibles as shipping connections, weather extremes, and consolidation problems was foreseen and overcome. But one hazard was overlooked. The rig was captured a month ago by the U. S. Customs Service, tying up the million-dollar drilling equipment.

Here's why—the rig was shipped to the southern waters of Alaska from Seattle to Seward by a Canadian tug company. The Merchant Marine Act prohibits use of foreign craft except on through shipping lanes.

The equipment, scheduled for arrival in May, didn't reach its destination until June. Payment of a $3,000 fine finally cleared the shipment. Under existing law a minimum penalty of confiscation of all the equipment could have been enforced.

The two barges carrying the supplies were operated by Vancouver Tug & Barge Co. and were towed by the firm's tug "La Pointe." Although Mountain States was considered as the shipper, the cargo was handled through Magnet Cove Barium Corp., Ltd., Calgary. The fine was paid at Anchorage but it was not disclosed which company made payment.

The basic rig, a National 125, was purchased from Carter Oil Co. which was operating it in Utah. It was transported to Seattle by truck. Recently the well was reported to be drilling below 3,400 ft. on the Standard of California-Richfield 12-27 Swanson River test—sixth hole in the Swanson River Unit.

Your supply store has this oil country favorite! Standard or Heavy Duty Insulated. Recessed spigot. Available with stainless steel liner. 1½ gal. to 25 gal.

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Easiest way to file and find confidential maps, tracings, blueprints. Quality metal cabinet file with locking doors. 112 tilting tubes handle 60" prints. Tubes indexed for quick location. Ideal for field and home offices. Shipped from stock.

Patent No. 1610368. Other Patents Pending.

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Every day, oil drums travel via the world's arteries . . . protected by gleaming coats of paint. International's research into drum paint development provides coatings which give complete protection under all conditions. Particularly recommended is Group 28 epoxide stoving drum paint whose diamond hard finish has fully proved itself against abrasion, rust, and the corrosive effects of acids, alkalis and solvents. For interiors, International have formulated a special epoxide stoving Drum Liner.

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Strong but light. Extremely rugged but flexible. That's Thermoid-Quaker "Quaflex" Oil Suction and Discharge Hose.

It's lighter than reinforced cotton-duck hose, but it won't expand under pressure. It won't collapse under suction. It's exceptionally kink- and crush-resistant.

For more details, call your local Thermoid distributor, or write to *Thermoid Division, H. K. Porter Company, Inc., Tacony and Comly Streets, Philadelphia 24, Pa.*

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Nylon tire cord for lightness, strength.

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Big questions deserve big answers. So, meet the latest addition to Core Lab's data processing center — IBM 650.

No mere calculator, the 650 can retain 20,000 digits of information (including Core Lab's vast storehouse of reservoir knowledge), remember instructions, and follow them with logical ability as it adds, subtracts, multiplies, and divides.

Put into service only recently, the system has already indicated the attainability of many new horizons of reservoir data application — a clean break through the barrier of manual limitations.

Whether your well or field problem involves the use of basic or special core analyses, fluid analysis, secondary recovery investigation and planning, reserves study and evaluation, or pure research, Core Lab's 650 now contributes its sophisticated talents to the project.

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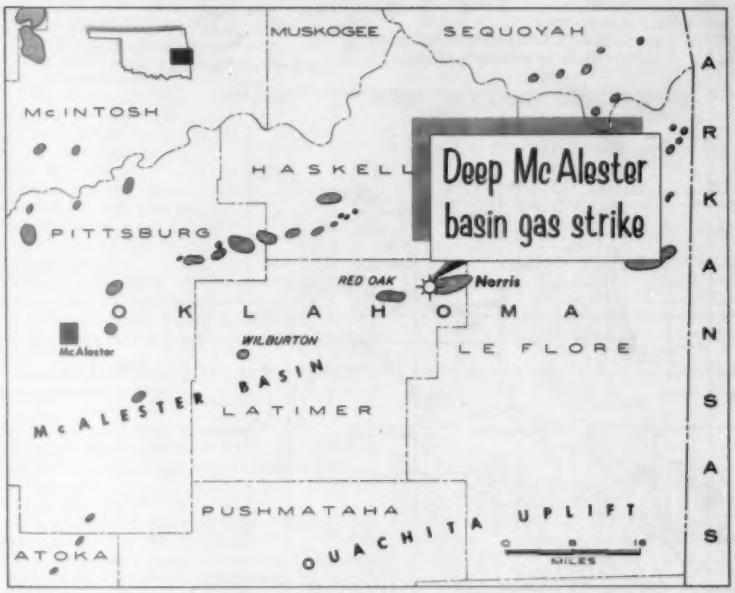

A DEEP TEST on the Brazil anticline, Latimer County, has revealed numerous commercial pay zones underlying eastern Oklahoma's McAlester basin. Its success should kick off a new era of deep drilling throughout the basin.

Deep wildcat highlights western McAlester basin

BY FRANK J. GARDNER

TEN YEARS AGO, the western Anadarko basin, centered in the Texas and Oklahoma panhandles, was a "least likely" region in the wildcatter's notebook. Today, it's probably the most active and rewarding theater of operations in the country, with a success ratio of 50% or more.

Ten years ago, the San Juan basin of northwestern New Mexico was dawdling along in a listless drilling program that gave no hint of what lay ahead. Today, it's a bustling competitor to Anadarko as the most active wildcat arena in the U. S.

A giant competitor . . . Ten years from now, we'll be saying the same thing about another giant gas bag that straddles the Oklahoma-Arkansas line. This is the McAlester basin. Here, after years of desultory exploration, a lively hunt for gas is gathering steam. A decade from now, Anadarko and San Juan may well have yielded center stage to this two-state gas basin.

What causes the delayed reaction in such regions? Early disappointments, expensive drilling, and doubtful markets, to name a few. But a couple of good discoveries, plus the prospect of an outlet, are enough to ignite a play. Follow these up with a 50% success story and a wave of "me, too" leasing, and a full-scale drilling boom ensues.

McAlester is on the threshold of such a boom. The discoveries have come, the success ratio has come, outlet prospects are brightening, and a lease wave has already engulfed the basin.

Expands to the west . . . So far, Arkansas has hogged the spotlight in leasing, drilling, and discovery. But now the counties of eastern Oklahoma are beginning to attract their share of attention. Lease and drilling deals are on the upswing, and good discoveries are punctuating the play.

Typical of these recent strikes is one in northeastern Latimer County, Oklahoma. Midwest Oil Corp. and Frankfort Oil Co. 1 Orr, in 8-6n-22e, is a deep 10,000-ft. test in the old shallow Norris-Red Oak gas field. It's the deepest wildcat so far in this county, and first to aim at the Cromwell-basal Pennsylvanian sand in this part of the basin.

This deeper-pool exploration has come up with multipay prospects in the Atoka-Pennsylvanian section to depths of nearly 8,000 ft. It's located on the huge Brazil anticline, a structure 20 miles long (east-west) and 6 miles wide. Operators have drilled it with air to its present casing point of 7,828 ft. Below that, air drilling (using nine compressors) continued to 8,713 ft. in Atoka shale, but deviation troubles forced a plugback to 7,828 ft. and a new hole is now being attempted there. In drilling this Atoka section, incidentally, Midwest recorded bit-life footages of 2,200, 1,850, and 1,650 ft.

So far, shows of gas have been posted at numerous levels between 3,440 and 7,952 ft. The best gages were found at 7,191 ft. (6.3 M.M.c.f. per day on 2-in.), 7,220 ft. (8.7 M.M.c.f. on 2-in.), and 7,270 ft. (12.3 M.M.c.f. on 2-in.). The maximum recorded gage was at 7,309 ft., where an 8-hour orifice-meter test made 17.5 M.M.c.f. per day.

The principal prospective pay in this discovery is a mid-Atoka sandstone from 7,191 to 7,336 ft., where net sand thickness is approximately 125 ft.

And changes some theories . . . Midwest has 75% working interest in this new strike, and Frankfort has 25%. Dry-hole money is coming from Sun Oil Co. and Le Flore County Gas & Electric Co. Geologically, it could be one of the most important tests in Oklahoma this year. It points the way to deep drilling farther into the Atokan depths of McAlester basin. More significantly, it just might change a lot of thinking from the surface structure to the stratigraphic subsurface approach. As one geologist puts it, "The 1 Orr highlights the stratigraphic potential here; it very well may not be structural."

So keep your eye on the two-state McAlester basin. It's 10 years behind the times.

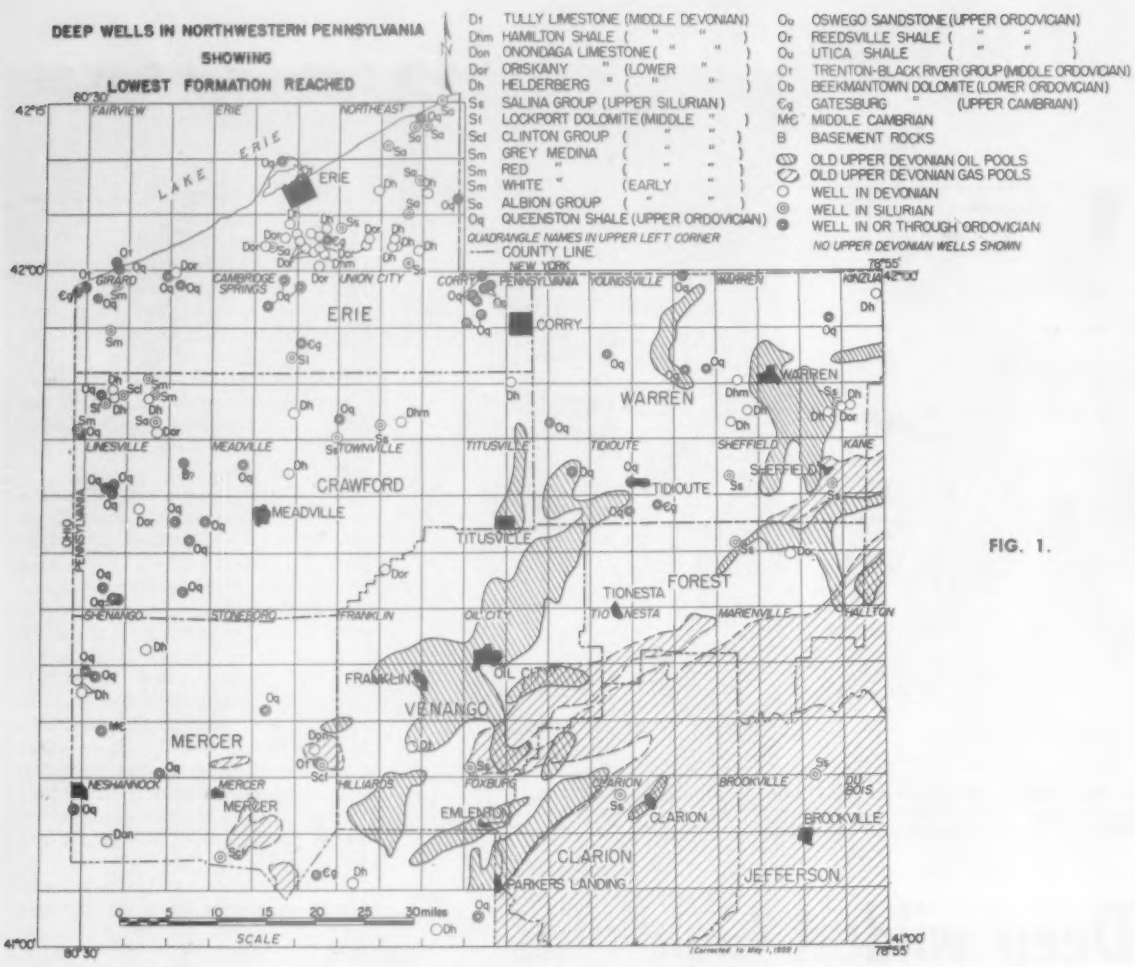

FIG. 1.

These areas have produced oil for decades from the industry's birthplace, but . . .

Is there more oil at Titusville?

By WALTER M. SMALL
Geologist
Cooperstown, Pa.

THE PHENOMENAL growth of the oil industry was triggered by the discovery of crude oil in the Drake well near Titusville in northwestern Pennsylvania in 1859. After 100 years it is still an important part of the economy of the region. However, from a growing enterprise the Pennsylvania oil industry has changed into one of diminishing reserves.

The natural-gas industry did much the same for many years, but recently it has shown vitality in discovering new Pennsylvania fields to reverse the trend. Modern techniques in hunting new reserves with up-to-date drilling and completion methods have much to do with this.

Stripper oil wells and crude from secondary recovery have provided refiners with sufficient runs to allow Pennsylvania Grade crude to hold an important place in the markets. Very active research in secondary recovery methods will help somewhat to stem the decline in production, but this does not assure growth or real permanency for the industry in this state. New reserves are badly needed.

It seems, then, high time to take stock of the situation to find out if the region has been explored, and if there are good chances for deeper producing formations to be found. It is the purpose of this article to point out facts in this connection for forward-looking operators and landowners. It is not a geologic report, though geologic and well data are mentioned and references to important publications are given.

Most of the production discovered until the mid-1920's was relatively shallow, and as fields declined and drilling methods permitted deeper and deeper wells, many old producing regions were rejuvenated by deeper discoveries. Many prospective areas, formerly thought to be too deep, turned out to be prolific. By 1955, over half of all oil discovered had been found in wells from depths of 3,000 to 6,000 ft.

Geological setting . . . The map (Fig. 1) shows the present and older producing areas of the region. The fields are in the Upper Devonian sandstones, accumulation being in "stratigraphic traps," not in anticlines or fault blocks. Surface rocks do not lend help to find such deposits, so that surface geology makes little contribution.

The eight counties shown on the

TABLE 1—GEOLOGIC SECTION FROM SAMPLE LOG
(Shaw No. 1 Well, North Edge Tidioute Quadrangle, Warren County, Pa. Elev. 1,708 ft. D.F. Courtesy of Biery & Johnson Co., owners.)

Formation—	Interval (ft.)	Reference, sea level (ft.)	Remarks
Shenango or Mt. ss. top of Mississippian	60	1,648	
Corry ss.	210-230	1,498	
Knapp (Spirifer) beds base of Miss., top of Devonian	-330	1,378	
First Venango ss.	465-475	1,243	
White oil ss.	520-530	1,188	
Second Venango ss.	555-575	1,143	
Little Minister ss.	670-680	1,038	
Third Venango ss.	710-729	998	Principal oil ss.
First Warren ss.	1,220-1,230	448	
Second Warren ss.	1,330-1,340	378	
Queen oil and gas ss.	1,410-1,440	298	Important producing ss.
Speechley ss.	1,650-1,670	58	Important gas ss.
Clarendon ss. (?)			
Cooper ss.	1,840-1,865	—132	
Tully Ls. and base of Upper Devonian	4,153-4,212	—2,445	Much used as key bed.
Onondaga Ls. (Middle Devonian)	4,445-4,525	—2,737	Unconformity —2,757 ft.
Oriskany Ls. and top of Lower Devonian	4,525-4,532	—2,817	Important gas producer.
Helderberg Ls. and base of Lower Devonian	4,532-4,630	—2,824	Basal member of Devonian sometimes missing.
Salina beds (Upper Silurian)	4,630-	—2,922	
Lockport dolomite	5,125?-5,670	—3,417?	Black Water —3,857 ft. Called Guelph. Often reefal.
Red Medina Lower Silurian	5,852-6,000	—4,144	4½ M.c.f. gas.
White Medina and base of Lower Silurian	6,010-6,024	—4,302	Also called Whirlpool.
Queenston shale and top of Ordovician	6,024-7,090	—4,316	Unconformity.
Oswego ss.	7,090-7,294	—5,382	Top and bottom uncertain.
Reedsville shale	7,308-7,905	—5,600	Gray shale.
Utica shale and base of Upper Ordovician	7,905-8,315	—6,195	Black shale.
Trenton Ls. Middle Ordovician	8,316	—6,607	Bottom not determined.
Black River and base of Middle Ordovician	-8,680	—6,972	Unconformity at base.
Beekmantown Lower Ordovician	8,983-9,121	—7,275	Ellenburger equivalent 75 M.c.f. gas.
Mines dolomite top of Cambrian	9,121-9,375	—7,413	
Gatesburg ss. Upper Cambrian	9,375-	—7,667	T.D. 9,410 ft. salt water.

ss. = sandstone. Ls. = limestone. Oil and gas indications: Oil stain —2,757 to —2,762 ft. and —2,767 to —2,772 ft. Stain and fluorescence —3,895 to —3,968 ft., —3,993 to —3,997 ft., and —4,145 to 4,167 ft. but could have come from upper show. Gas show in chert —2,782 ft., show —4,195 ft. and 4½ M.c.f. at —4,225 ft. 75 M.c.f. at —7,371 ft. Water fracturing unsuccessful.

map are a part of the Appalachian synclinorium. Topographically, the region is mostly a part of the eroded slope of the Allegheny Plateau as it merges into plains near the Ohio state line. The hilly landscape is broken by the shore zone of Lake Erie, and all the north and west parts were modified by continental glaciation.

With the exception of a narrow area along Lake Erie, the drainage goes into the Ohio River via the Allegheny on the east side, and from Mercer County and a part of Crawford County through the Shenango and Beaver rivers. The Allegheny and its tributaries have trenched the peneplain of the Allegheny Plateau with rather steep-walled valleys along the major drainage, leaving rolling upland between the streams.

The bedrock of most of Erie County and the hills of much of northern Warren County consist of Upper Devonian shales and sandstones, which reach southward along major stream channels. Most of Crawford County and much of western Warren County have as surface rocks Mississippian sandstones and conglomerates with minor shale beds; these formations extend southward across western Mercer County and along the deeply cut stream channels of Venango and Forest counties. Minor ridges of northern Crawford and southern Warren counties have outliers of Pennsylvanian sandstones, which with some shales and with coal beds coming in progressively southward, form the bedrock of the upland and most of the stream channels of eastern and southern Mercer, a part of Venango, and all of Forest, Clarion and Jefferson counties.

As for the immediate subsurface rocks of the old oil-fields area, considerable work has been published on the Upper Devonian. The most useful subsurface publications on the Middle Devonian and older rocks have been done by Earl H. Linn, C. R. Fettke, and the Pennsylvania State Topographic and Geological Survey.

Possible pays . . . In order to avoid repetition of published data, it is suggested that the reader refer to maps, sections, and isopachs as well as to text of Earl H. Linn's "Sedimentation, Key to Appalachian Production" in the April 30, 1956, issue of The Oil and Gas Journal, and to "Structure-Contour Maps of the Plateau Region of North Central and Western Pennsylvania" by C. R. Fettke, (Bull. G 27, Pa. Topographic and Geo. Sur. 1954). These two authors have given a valuable contribution.

In evaluating the contour maps, one should consider the density of control wells by reference to the map

About the author . . .

Walter M. Small has broad geological experience—25 years foreign and 15 years throughout the U. S. Overseas assignments include exploration in Angolia, Portuguese West Africa, Czechoslovakia, Hungary, Yugoslavia, Egypt, Romania, and Dominican Republic. Other stints were spent in western Canada and Mexico. Domestically he has worked in the Appalachian, Mid-Continent, Gulf Coast, Rocky Mountain, and West Coast areas. From 1947, when he retired from Standard Oil Co. (N. J.), to 1952 he was consultant for Husky Oil Co. He is now a consulting geologist and is also president of Middle District Producers' Association and a director of Penn Grade Crude Oil Association. The author has coped with a diversity of exploration problems during his long career.

TABLE 2—UNTESTED AREAS AND DENSITY OF EXPLORATORY WELLS IN NORTHWESTERN PENNSYLVANIA

County—	Total area (sq. miles)	Areas untested (sq. miles) In Lower Devonian	Through Medina group	In Trenton	Below Trenton
Clarion	599	(†)	583	599	599
Crawford	1,016	350*	638	1,000	1,000
Erie (not including offshore area)	812	250*	325	687	758
Forest	420	210*	420	420	420
Jefferson (west part)	400	(†)	368	400	400
Mercer	681	440*	600	650	665
Venango	675	435*	675	675	675
Warren	910	470*	750	894	894
Total area	5,513	2,155*	4,359	5,325	5,411

Density of Exploratory Wells

County—	Area (sq. miles)	Ratio of wells to sq. miles: Lower Devonian	Medina group	Trenton	Pre-Trenton
Clarion	599	1:599‡	1:599	Untested	Untested
Crawford	1,016	1:42*	1:72	1:500	1:1,000
Erie	812	1:15*	1:54	1:135	1:270
Forest	420	1:72*	1:420	1:420	1:420
Jefferson (West part)	400	1:200§	1:400	1:400	1:400
Mercer	681	1:56*	1:227	1:340	1:680
Venango	675	1:435*	1:675	1:675	1:675
Warren	910	1:28*	1:100	1:900	1:900

*Corrected for areas with poor prospect of Oriskany sand, according to Bull. M 31, Pa. Geol. Survey. †Probably absent. ‡Poor prospect. §Dor. probably absent.

NOTE: No wells in Upper Devonian used in calculation.

(Fig. 1). This applies also to areas delineated as having no Oriskany sandstone in the subsurface.

This writer does not agree with a statement by Parke A. Dickey on p. 287 of The Oil and Gas Journal, September 15, 1958:

> "The reason is geological. There are no good reservoir rocks between the Devonian in which the oil and gas occur, and the Ordovician which is deeper than 10,000 ft. and is still mostly beyond reach of the drill."

In most of the area under examination, the Ordovician lies at less than 10,000 ft. Moreover, this depth is not generally considered prohibitive.

Reference is suggested to Chas. R. Fettke's "Summarized Record of Deep Wells in Pennsylvania," (Bull. M 31, Topographic and Geo. Sur., 1950), and to Table 1. Between the Lower Devonian and the Ordovician there occur fairly generally in the subsurface potential oil and gas reservoirs in the Lockport (Guelph) dolomite, and in the Clinton, Grey, Red, and White (Whirlpool) Medina. Since all of these have shown or produced some oil or gas somewhere in the general region, they should not be ignored. Moreover, the Ordovician contains over most of the area the Oswego sandstone, Trenton limestone, and the Beekmantown (Ellenburger equivalent) with the Mines dolomites, and the Gatesburg sandstone in the Upper Cambrian. And all of these occur above 10,000 ft. (see Table 1).

Samples are scarce . . . Facies studies of subsurface reservoir beds are limited by the number and position of wells supplying the samples. Reference to the map shows that much of the region is without samples for such investigations. There are only 12 detailed well-sample descriptions available for the area, and even fewer radiation logs have been released.

The deeper subsurface structure which influences the changes of facies is too little known through the several important unconformities. There is often unconformity between Middle and Lower Devonian. Over much of the region, there is an unconformity at the base of the Silurian and another in Middle Ordovician.

Anyone experienced in the development of oil fields will need no crystal ball to see revision after revision of subsurface and facies maps as sample information is released once deep drilling gets under way.

With these lines on the subject of the rock section, another aspect of the geological situation should be examined—that of the position of the area with respect to the sedimentary basin.

In recent years stress has been laid upon "basin studies" and the locations of the great oil discoveries within them. For the reader wishing a summary of facts about these matters, "Habitat of Oil," published by the AAPG in June 1958, pp. 1-61, is recommended. A second paper in the same volume, pp. 447-472, shows how basin position has been related to oil occurrence in Illinois. A graphic summary of "Where the Free World's Oil Has Been Found" is printed on the back cover of "The Lamp," house organ of the Standard Oil Co. (N. J.), Vol. 38, No. 4, winter 1956; the full article appeared in AAPG bulletin, Vol. 40, No. 4, 1956.

Hinge line complexion . . . From the results of this statistical research, certain general conclusions may be drawn:

- About 80% of the world's oil already produced has come from anticlinal structures.
- Except for known structures, most of the new oil yet to be discovered will have to be found in non-anticlinal traps such as unconformities, reefs, concealed faults and lensing reservoirs or "strat traps."

Accumulation in the major fields of the world has been about 50% on hinge lines, 32% toward the deeper parts and along the mobile belts of the basins, and only some 14% on the shelves. Where then, in the segment of the Appalachian basin under review, should one look for geologic conditions most likely to have undiscovered reserves?

Referring again to Linn's report in the April 30, 1956, issue of the Journal, it will be seen that a hinge line crosses northeast - southwest through Crawford County, with the basin deep toward the south and southeast, and the shelf lying in northwestern Crawford County and Erie County. There may be a deeper subsurface hinging connected with this, but lack of well data does not permit conjecture further than this.

Faulting and lensing . . . It would be logical to expect faulting to have occurred along the front of the "hinge" just mentioned, as the basin deepened on the south and southeast with its fill of sediments thickening in that direction. The Appalachian basin is more depositional than structural throughout most of Paleozoic time.

Looking at the sedimentary series from the southeast, formations appear to be thinning or pinching out toward the north and northwest. There is insufficient information on the paleogeography of the subsurface rocks to predict in which part of the section sandstone lenses are to be expected, but since several unconformities (See Table 1) shoaled the waters, it is not

too much to expect porosity zones. They could be sandstone, reefal deposits, or secondary as the result of solution or fracture zones in limestones and dolomites.

Theoretically, then, in the absence of anticlinal traps, there are possibilities of faulting, fracturing of limestones, biostrom and bioherm reefal deposits, unconformity traps and lensing-out updip traps or "strat traps." There is one area at least where dolomitization of the Trenton limestone might well have occurred, but that is entirely theory.

As to depths, again an analogy is in order since we are dealing with appropriate thickness of petroliferous rocks. Over 75% of the world's oil has been found between 3,000 and 8,000 ft. These are the depth ranges of probable reservoirs along and on the front of the hinge line just mentioned.

Relative Density of Exploration Wells

To determine the degree or density of exploration already attained in an area, we must take into account the location and depth of wildcat wells, as well as the oldest geologic formation tested. In the case of the region under study, it should be borne in mind that few of the well locations were made with geological or geophysical data to guide in the selection; that very few cores were taken; that many had no systematic method of sampling; and that the great majority were drilled before electric or radiation logging and formation fracturing were practiced.

In preparing the chart (Table 2), only wells drilled into pre-Upper Devonian rocks were used. These were then classified according to important formations tested. Wells in each of these were then counted and appropriate amount of area subtracted; it was assumed that each test or close group of tests condemns 16 sq. miles, i.e., a distance of 2 miles from each dry hole.

Subtracting the total for each county from its area gives an idea of what remains untested. Dividing the county areas by the total number of tests or close group of tests gives the number of square miles per dry hole. In the case of the Lower Devonian-Oriskany sand, a correction was made for areas considered to be without prospect of gas sand, as noted on the chart. Future drilling may prove some of this area productive, however.

Untested areas . . . Of the 5,513 sq. miles covered by the map, there remain untested 2,155 sq. miles in the Oriskany, 4,359 sq. miles in the Medina, 5,325 sq. miles in the Trenton, and 5,411 sq. miles in pre-Trenton (Table 2). The density per wildcat in each of the several categories is absurdly low, except for a few areas. For this reason, the chart carries comparative data for several oil-producing states (Table 3).

TABLE 3—COMPARATIVE DENSITY OF EXPLORATORY WELLS IN OTHER OIL-PRODUCING STATES*
(Dry holes per sq. mile of prospective sedimentary basin area)

Alabama	1: 75.40
Arkansas	1: 10.35
Colorado	1: 13.29
Illinois	1: 1.87
Indiana	1: 2.97
Kansas	1: 4.06
Kentucky	1: 2.31
Montana	1: 31.00
Oklahoma	1: 1.25

Average for Northwestern Pennsylvania calculated in a comparable way would be for Pre-Upper Devonian about 1:45 sq. mile.

*Courtesy of Raymond D. Sloan, Div. Mgr., Carter Oil Co., Denver.

Dry hole density . . . In GeoTimes, Vol. 3, No. 1 on p. 22, B. W. Beebe, a well-known geologist of Oklahoma City, states:

> "Only one dry hole has been drilled for each 38 sq. miles of surface sedimentary area in the Rocky Mountains. This compares with one dry hole for each 1.26 sq. miles in Oklahoma; 1.9 sq. miles in Illinois; 4.23 sq. miles in Kansas; or 6.7 sq. miles for the entire Mid-Continent area."

Nothing was stated about what was considered to be a dry hole, but it must be assumed that it referred to a test well which to a greater or lesser degree condemned a local area. For the region here discussed, the average is one well for 45 sq. miles.

Attention is called (Fig. 1) to a block of territory including most of Forest County, northern Jefferson County, a large part of Clarion County, almost all of Venango County and much of Crawford and Mercer counties with a total area of approximately 1,800 sq. miles in which there is only one test hole as deep as the Oriskany. The block extends from the hinge line of the Crawford arch southeastward across the part of the basin where both subsurface structural conditions and the lensing of formations may be favorable for strat traps. It contains an enormous volume of wholly untested rocks of known petroliferous character.

Roundup . . . In the light of the foregoing, it is obvious that:

- Much of the Onondaga-Oriskany territory is untested.
- Four-fifths of the Silurian (Lockport through the Medina group) remains unexplored.
- The Trenton-Beekmantown, plus the Upper Cambrian rocks, is 98% in the same category.

Study of the map (Fig. 1) shows areas up to 10 townships in size entirely untested as deep as the Oriskany. This would seem to be rather anomalous in view of the interest taken in western Canada, Montana, and the Dakotas, parts of the Southwest and in the Mountain States where sediments of the same age, yet at greater depth and much farther from market are being vigorously explored, both by geophysical methods and by deep drilling.

There are a few forward-looking operators who have pioneered deep drilling in Erie, Crawford, Mercer, and Warren counties in recent years. They have, it is true, made no spectacular discoveries although, thanks to good samples (Table 1), and detailed completion reports, very much has been added to the subsurface data of the region.

At this writing, a few major companies have men studying the basin, one major has a sizable block newly leased, and deep drilling is being discussed by independents. No information is at hand of large-scale geophysical surveys having been made with modern techniques.

Suggested programs . . . In drilling deep holes below the Venango sands, it is urged that 5-ft. samples be taken with care and made available for study, that prospective reservoir strata be cored, and that electric or radiation logs be made. Core samples should be examined by a competent specialist for silt before deciding to use water in fracturing.

All operators in northwestern Pennsylvania, northeastern Ohio, and southwestern New York should join in using their influence to get a regional survey by airborne magnetometer. It might be possible to get some cooperation from the USGS.

If a tristate project could be achieved, it would be cheaper for each state, and it would afford much better possibility for useful data being interpreted on depth and grain line of the basement rocks. This might serve as a starting point for other geophysical surveys. Modern methods of recording and interpreting reflection seismic data give some stratigraphic information as well as structure. A pool should be set up to make and distribute velocity logs on any deep wells completed so that such information is not lost to the industry; accurate velocity data makes possible

more accurate interpretation of results.

The problems which challenge the operator here are fundamentally not unlike those in West Texas, Oklahoma, and parts of the Mountain States where exploration for Paleozoic oil and gas goes forward. Generally speaking, relatively shallower depths and better communications facilities here will make the cost less. Oil markets are good, the declining production has no proration headaches, and gas markets are excellent.

The writer believes that when modern methods of oil finding are applied to this region on a scale comparable to those in our western and southwestern states, favorable results may be expected.

Acknowledgments

Assistance was rendered in preparing the data and the map by W. S. Lytle, assistant state geologist, and W. R. Wagner of the Pennsylvania State Topographic and Geologic Survey in the Pittsburgh office; F. Arthur Johnson, petroleum engineer, Oil City, Pa., abstracted the Biery and Johnson well-sample log; and Raymond D. Sloan, division manager of the Carter Oil Co., Denver, provided statistical charts of the density of exploration wells in the central and western states.

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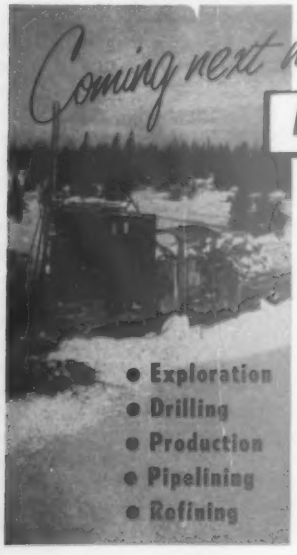
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EXPLORING the Arctic and drilling in Lake Erie are only two of the fascinating subjects on tap in next week's special Journal Report on Canada.
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• Refining

Oklahoma's Harper adds seventh pay

North Buffalo, the field of many pays in Harper County, Oklahoma Panhandle, has good prospects of adding a seventh zone to the record.

Sinclair Oil & Gas Co. 1 Robert R. Rohrer, SW NE 6-28n-22w, 7 miles north of Buffalo townsite, perforated at 5,662-74 ft. in the Morrow sand. Operators swabbed into pits for 4 hours. The well then flowed at the rate of 4,352 M.c.f.d. for 12 hours through ¾-in. choke, with tubing pressure at 400 psi. Condensate yield on the test was 6 bbl., cut with load water.

No. 1 Rohrer already has assured production from the Kansas City lime, one of the oil pays in the field. Other pays in the area include the Lansing, Oswego, Chester, Viola, and Arbuckle.

New field tapped in North Louisiana

Discovery of another Cotton Valley field for North Louisiana is indicated by gas-condensate showings in a wildcat Magnolia Petroleum Co. is drilling 1½ miles northeast of Blackburn, in Claiborne Parish.

The wildcat, 1 Thelma Worley, in 34-22n-8w, is 3 miles southeast of Blackburn field, where there is one well with production from the Cotton Valley-Bodcaw zone at 8,700 ft. It is nearly 4 miles northwest of the old Home field, productive from several Cotton Valley zones as well as from shallower pays.

A drill-stem test at 9,218-33 ft. in the Cotton Valley in Magnolia wildcat got 140 ft. of condensate and 510 ft. of condensate-cut water and mud. Bottom-hole pressures were 2,725 psi., flowing, and 5,025 psi., shut in.

Montana's Central Plains hit year's first big oil

Central Montana has its first big oil strike of the year at L. L. Tuck and Will I. Lewis 1-B Kincheloe in Rosebud County's 18-11n-32e, SW SW.

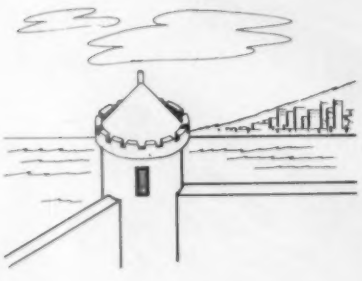
The operators swabbed 225 bbl. of oil in 6 hours, then swabbed 225 bbl. in 7 hours at this Tyler sand discovery. Perforations were at 4,580-88, 4,590-95, and 4,597-4,606 ft. Reports have it that pump will be installed. Another wildcat is drilling in this area. It is the 1-C Kincheloe in SW NW 33-11n-32e. Drilling is below 4,620 ft.

Foreign lands lure Atlantic

. . . from the Caribbean to the Aegean

HERE'S WHAT one company did last year in overseas exploration. The Atlantic Refining Co. was busy in six foreign countries.

In Cuba . . . Atlantic had dry holes in the drilling of one joint-interest and two full-interest wells. Other prospects are being tested by farming out tracts to other companies. Late last



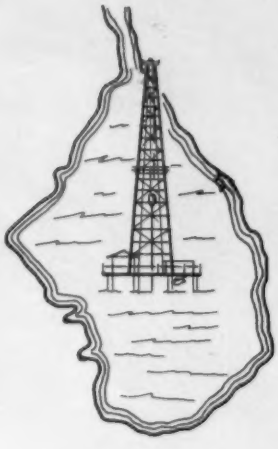
year Atlantic's newly developed seep survey technique was used in the shallow waters along the north coast of Cuba. These results are now being evaluated.

In Guatemala . . . Based on exploratory work performed during the past year in Guatemala, a joint-interest

test well will be drilled by Atlantic in 1959.

In Venezuela . . . Atlantic's most important foreign drilling and production last year was in this South American oil giant. Year-end volumes amounted to 30,700 net bbl. daily compared to 21,800 at the end of 1957.

In Lake Maracaibo Block 1, a 24,700-acre tract in which Atlantic has 45% interest, a prolific oil field has



been proved. Practically all of the 19 wells completed contained 250 to 1,400 ft. of oil sands. The average test flow per well exceeded 6,000 bbl. daily. Gross production potential should rise to 100,000 bbl. daily when a flow station to a shore base is completed.

The company will drill on its ⅓ interest at Lake Maracaibo Block 12, a 25,000-acre tract adjoining Block 1. Plans call for 1959 drilling here. The company completed 27 net successful wells in eastern Venezuela at Oritupano, Aguasay, Tacat, and Pirital.

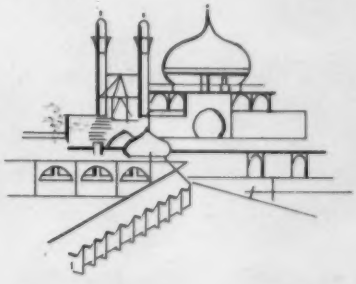
In Bolivia . . . Atlantic acquired an option to earn an 80% interest in about 1,250,000 acres in a favorably located geological area in eastern

Bolivia. The company will conduct photogeologic and surface geology studies there during the 1959 dry season.

In Syria . . . The company is negotiating with the new government here

to secure an exploitation concession and recognition of Atlantic's contribution to the search for oil in Syria.

In Turkey . . . Additional geological and geophysical work was carried on during 1958 on the 3,600,000 acres in which Atlantic owns a one-third



interest and a number of favorable structures have been mapped. Drilling is now in progress in Turkey.

Michigan wildcat logs oil shows

OIL SHOWINGS have been logged in a wildcat 50 miles west and north of the Albion Trenton play in Allegan County, Michigan. They were in the Trenton in which a drill-stem test at 3,738-90 ft. recovered 120 ft. of oil-cut mud.

The wildcat, 1 Boss, drilled by G. W. Strake, has been deepened to 4,205 ft. without logging additional shows. Location is in the SE NW NE 25-2n-12w.

Another Michigan wildcat, Bell & Gault Drilling Co. 1 Bissell, in Jackson County, has tested gas in its second Trenton zone. From this zone, at 4,048-50 ft., the well flowed at the rate of 8,300 M.c.f.d.

Previously, this wildcat had tested a zone at 3,989-4,012 ft., flowing 3,800 M.c.f.d. This zone was cased off. Gas in the lower zone also has been killed and the zone squeeze-cemented. Hole will be deepened. Location is in the SE SW NE 8-4s-2w.

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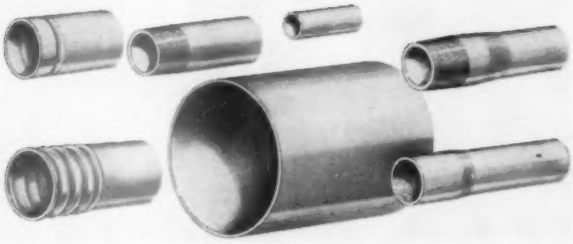

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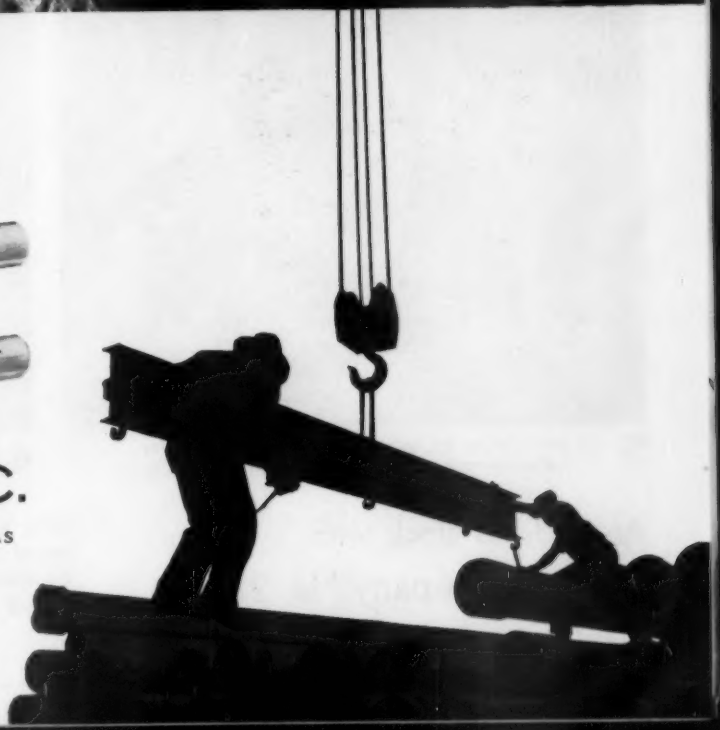


Canadian followup successful

FOLLOWUP DRILLING to a pair of oil-discovery wells in northwestern Alberta, Canada, has resulted in their first additional production.

One of the discovery holes was drilled in 1954. The other was completed early this year.

The 1954 discovery is on a Cambrian play in the Gilwood-Stugeon Lake district, 165 miles northwest of Edmonton. The followup well, drilled by Tennessee Gas Transmission Co., flowed at the rate of 50 bbl. of 40°-gravity oil per hour during a drill-stem test.

The test took in a 27-ft. interval at 8,100 ft. Oil was at the surface in 36 minutes. No water was indicated.

Discovery well, Great Plains et al. Gilwood 1-9, had an initial potential of 228 bbl. of oil daily. Tennessee Gas Transmission's followup well is ¼ mile east. First followup attempt was by Stanolind Oil & Gas Co. (now Pan American Petroleum Corp.) ⅝ mile northwest. The latter well now is being used for salt water disposal.

The other new followup development is in the Eaglesham area, 50 miles northwest of the Gilwood wells. There, Hudson's Bay Oil & Gas Co., Ltd., and Union Oil Co. of California, have 50 ft. of pay in the discovery well's D3 Devonian reef producing horizon, contacted at 7,500 ft. A drill-stem test recovered 1,150 ft. of clean oil and 90 ft. oil and gas-cut mud. Gas flow during the test was at the rate of 734 M.c.f.d., and carried an oil spray.

The well, 2 Eaglesham, in LSD 2, 14-77-25w4, is ½ mile south of the same operators' discovery well, which flowed at the rate of 172 bbl. of clean oil daily for a potential rating. It is 5 miles east of these operators' 1 Eaglesham Mississippian gas-discovery well.

1 Breakfast comes early for members of Imperial Oil's geological party No. 29 in the Canadian Rockies.

2 Pilot Wilf Pinner twirls the rotor and the crews take off for Try Mountain.

5 The job goes on by lantern light for Walter Ziegler. Today's geological measurements are correlated with an aerial map.

6 Fossils must be labeled, and rock samples must be crated for shipment back to Imperial's laboratory.

Around the clock with Imperial Oil's party No. 29

THE VANGUARD of every oil search is the geological surface party. Man's thirst for more oil takes the rockhound into many regions. One of the most heavily traveled geologic hunting grounds is western

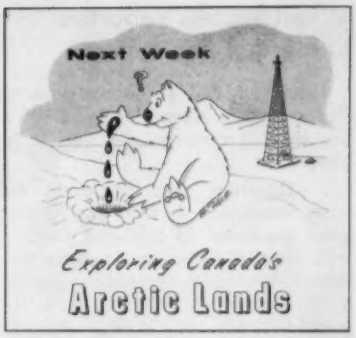
Ohio pool gets new addition

A NEW addition to the Canaan pool in Wayne County, Ohio, has been made with the completion of R. S. King, 1 Harry Snyder. This well, located in the NE¼ of Section 3, Canaan Township, showed 8 M.c.f. of gas and 10 bbl. of oil natural from the Clinton sand. After fracture treatment with 2,350 bbl. of oil and 70,500 lb. of sand the well gaged 692 M.c.f. of gas and 300 bbl. of oil. The Clinton sand was logged at 3,012-22, 3,033-47, and 3,072-3,100 ft. with shows in all three zones. Total depth was 3,255 ft. Rock pressure was 625 psi.

A new wildcat well has been slated for northeastern Ohio. J. E. Dinger and associates have picked a location in Lot 25, Hartford Township, Trumbull County, for a Clinton test. The Clinton sand is virtually untested in this area and the few wells drilled in the near vicinity have all recorded shows. The Clinton sand lies over 4,000 ft. beneath the surface in this area.

Ohio gets new pool opener

In Ohio a successful pool opener in Section 15 of Berlin Township, Holmes County, was completed by Baldwin Realy. The 1 Abraham Miller logged the Clinton at 4,083-4,103 ft. and gaged 75 bbl. oil. The Miller is the first oil producer for the township.



3 Bob Griffin and Ernie Manko gather rock samples, measure formations, and map face of mountain.

4 Here's a job with a view and lunch in the clouds. Noon finds the men near 10,000 ft.

7 The day's work done, there's still time for letters home or sorting notes for reports to be written.

8 Washtubs serve a dual purpose for Jim Wood. Here's a welcome escape from a busy day on the mountain.

Canada. Imperial's party No. 29 works high in the Rockies from May to September looking for secrets hid in the mountains of rock that might help the drillers far out in the plains country of the western provinces. For these high exposures of strata yield data useful to wildcatters drilling into the same strata miles away. The samples will aid those looking for oil in the prairie provinces.

Mixed success reported in North Tejon tests

Latest activity at booming North Tejon field in Kern County, California, showed mixed results. Here's the picture:

...Highway area. Richfield Oil Corp. continued its record of getting good producers in this area about 1 mile west of the main discovery well with a 468-bbl. daily producer on the south edge of the Highway area. The Richfield test, 85-24 ROC-KCL-G, was completed in a number of selectively perforated intervals between 10,886-11,402 ft. Production in the 11,404-ft. well was 42.3° gravity, 3.2% cut, 3,196 M.c.f. daily through an 18/64-in. choke.

...Main area. Results of Reserve Oil & Gas Co.'s effort to extend the Main area 1¾ miles east were still clouded. Reserve was deciding what to do next after running tests on a 12,947-ft. wildcat drilled in the east extension effort. The operator reportedly tested the interval 12,077-12,160 ft. but results were not released.

...South Highway area. Texaco, Inc., was trying to get a producer out of a well drilled on the east edge of the extreme southern end of the Highway area. The well, 3 Tejon C, was completed making 203 bbl. daily of circulating oil from intervals in the Eocene at 11,242-11,481 ft. and the Z-1 at 8,754-9,046 ft.

River Island gas field extended southeastward

E. C. Brown, operator, successfully extended production in River Island gas field, Sacramento County, California, by completing a test about ¾ mile east of the nearest producer in the southeast section of the field. The Brown well, 1 R. D. Graham, found the productive Nortonville sand at 3,680-88 ft. in the 3,911-ft. test. The well was brought in flowing 1,100 M.c.f. daily through a ⅞-in. choke.

Two offshore tests abandoned, suspended

Phillips Petroleum Co. recently suspended operations on its third core hole drilled on offshore Parcel E, the most westerly of five awarded by the state last year off Santa Barbara County, California. Phillips drilled to 5,010 ft. at a site 1 mile offshore in 63 ft. of water. The hole was drilled from a floating barge. No results were released.

Immediately to the east of the Phillips parcel, Texaco, Inc., drilled and abandoned its third core test on Parcel D. It was drilled to 7,447 ft. from a floating barge located 8,500 ft. offshore in 111 ft. of water.

Shallow pool found at Willow Pass

The recently discovered Willow Pass gas field in Contra Costa County, California, yielded a second zone in the first offset drilled. Trico Oil & Gas Co. moved to a southeast offset location where a 1,946-ft. well found a shallower pool at various intervals between 1,498-1,680 ft. It was completed in the shallow pool flowing

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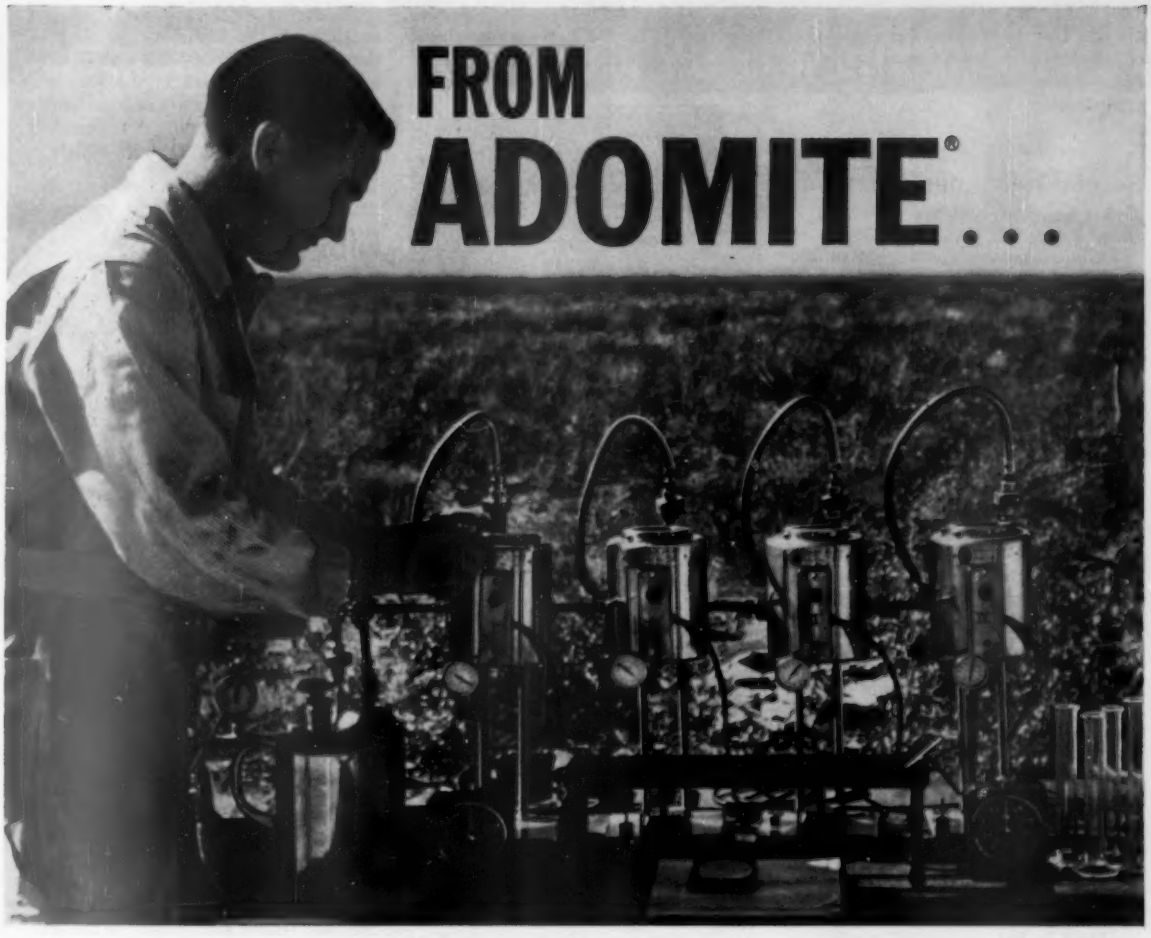

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1,500 M.c.f. daily through 3/8-in. choke. The field discovery well was completed in a gas sand at 1,714-77 ft. It made 4,300 M.c.f. daily on its completion.

Second test slated for Arkansas' Franklin

Drilling already is under way on the second test for the new Paleozoic area 3 miles northeast of Watalulu, in Franklin County, northwestern Arkansas, where Arkansas Western Gas Co. has an indicated gas-discovery well.

The new test, a mile north of Arkansas Natural's well, is being drilled by Stephens, Inc., of Fort Smith. Spot location, at 1 Harris Estate, is in 17-11n-26w. Projected depth for the test is 3,000 ft.

The area is 35 miles northeast of Fort Smith. It is 4 to 5 miles northeast of nearest gas production, in Watalulu field with dry holes between.

Arkansas Natural's well has not been completed officially but flowed an estimated 900 M.c.f.d. of gas from sand at 1,781-85 ft. and 1,812-15 ft., and 1,250 M.c.f.d. at 2,022 ft. in preliminary formation tests.

Since then, hole has been drilled to 2,884 ft., and production string cemented. This string has been perforated at 1,776-90 ft. and 1,795-1,811 ft., and in the deeper zone of 2,018-23 ft. The well has been swabbed in but no test of production has been made.

South Dakota gets third oil field

South Dakota has a new oil field, its third. Shell Oil Co. completed its 1 Tilus in C SW NW 11-20n-4e, Harding County, 5 miles south of Buffalo field, pumping 111 bbl. of oil and 109 bbl. water per day. Production is from Red River Ordovician perforations at 8,365-67 ft.

Nearest production is about 2 miles northwest at an unnamed 1959 discovery of Shell's in Harding County.

New Olmos gas uncovered in Texas' Dimmit County

Another Olmos-sand gas discovery is reported in northwestern Dimmit County, Southwest Texas. It is by Michael T. Halbouty and Pronto Drilling Co. at their 4 Robert Shook wildcat, 8 miles southwest of Carrizo Springs.

Completion is from perforated interval at 2,984-95 ft. with potential flow of 1,500 M.c.f. of gas daily. Shut-in pressure is 936 psi.

GLADY FIELD, fastest growing gas reservoir in West Virginia.

West Virginia adds Glady well

IN WEST VIRGINIA'S growing Glady gas field, Columbian Carbon Co. has completed the GW-1296, U. S. A. J-1, Pocahontas 14 well for 1,677 M.c.f.d. through 5½-in. production string after fracture. Production is from both Chert and Oriskany with total depth at 6,186 ft.

This new producer is located on the Blackwater anticline in Glady field, Pocahontas County, Greenbank district, on the Durbin Quadrangle. It is the twenty-seventh completion for Glady, and is the southernmost producer in the field. This field now extends an approximate distance of 16 miles long and 2 miles wide. It straddles portions of Pocahontas and Randolph counties. There have been only two dry holes drilled. One, the Pocahontas 12, was drilled by United Fuel Gas Co. on the eastern flank. Benedum-Trees Oil Co. drilled Pocahontas 13 dry about 7 miles south of the Columbian Carbon Co. GW-1296 well.

Benedum-Trees is drilling another well at Pocahontas 16, A. C. Simmons 1. It is 7,200 ft. southwest of its dry hole. Columbian Carbon Co. has four tests under way in the field now, located at intervals along the anticline. They are the Randolph 104, 105, 107, and 108. Pocahontas 17 has been staked 8,500 ft. southwest of the GW-1296 well.

Glady field is turned into line and feeds during winter months. It is shut in through the summer, or used in the same manner as the state's storage fields. Producers in the area are very optimistic about Glady's future and are closely watching developments of the Benedum-Trees well which is now drilling at 7,216 ft.

Fifth producer for Nicholas County

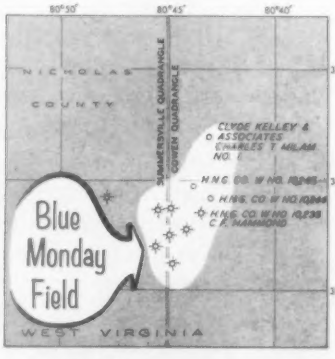
A SHALLOW gas field in West Virginia's Nicholas County gained a fifth producer. Hope Natural Gas Co. completed 10238-C. F. Hammond, Nicholas County 227, for 3,396 M.c.f.d. through 7-in. production string after fracture. Total depth is 1,924 ft. Production is from Blue Monday sand. This is the second completion in which water was encountered, necessitating a string of 2⅜-in. tubing to be used as a siphon.

This well is situated 2,700 ft. southeast of Hope Natural Gas Co. 10212 which flowed 14,468 M.c.f.d. Location is in Beaver district, Cowen Quadrangle.

Hope has drilled all five producers in the field, totaling an open-flow potential of 29,425 M.c.f.d. Three dry holes have been drilled, one by Hope, one by C. K. Sparks, and a wildcat by United Producing Co., Inc. This one proved the southeast boundary of the field.

Hope has staked two other wells, the No. 10244 and 10245 on the Ely-Thomas Lumber Co. lease which contains 700 acres. Nicholas permits 229 and 230, respectively, these tests will determine the immediate northeastern side of the field, although there is a wildcat now drilling about 3 miles northeast at Clyde Kelley & Associates, Nicholas 225.

Hope recently completed a 6-in. line into the field and delivery is expected about the middle of August.


NICHOLAS COUNTY
SUMMERSVILLE QUADRANGLE
COWEN QUADRANGLE
CLYDE KELLEY & ASSOCIATES CHARLES T. MILAM NO. 1
H.N.G. CO. W NO. 10245
H.N.G. CO. W NO. 10244
H.N.G. CO. W NO. 10238 C. F. HAMMOND
Blue Monday Field
WEST VIRGINIA

FIFTH PRODUCER was added to Blue Monday gas field in Nicholas County, West Virginia.

Deep tests scheduled in Texas Panhandle

Locations have been made for two rank wildcats in the Texas Panhandle. Shell Oil Co. will try again in the Palo Duro basin, and Gulf Oil Corp. will drill in the Anadarko basin. The latter test, projected to 16,000 ft., will be one of the three deepest exploratory tests in the Panhandle of Texas.

. . . Palo Duro basin. Shell 1-84 Fulton Ranch has been spotted in the SW SE of Section 84, Fulton Ranch Subdivision, in north-central Oldham County. Projected depth is 7,100 ft. Drill site is 12½ miles northwest of Southeast Alamosa (Missouri) field and 25 miles northwest of Vega townsite. Shell holds a 14,400-acre lease.

Gulf's deep wildcat is the 1 A. Bowers, 22 miles southeast of Canadian in Hemphill County, in Section 255, Block C, G&MMB&A Survey. Operations are scheduled to start immediately.

Drill site is 20 miles south of deep production in northern Hemphill County, and 12 miles southeast of Sinclair Oil Co.'s 1 Isaacs, a 13,500-ft. dry hole.

The two other deep Panhandle tests are Magnolia Petroleum Co. 1 D. D. Feldman, in Feldman field of Hemphill County, which drilled to 15,997 ft., and Max Pray 1 R. D. Mills, a 17,156-ft. duster in southeastern Wheeler County.

Heavy oil flow opens field in Jack County

THE EXTREME southwestern corner of Jack County, North Texas, gained a new Mississippian field, and operators have scheduled immediate development.

The new producer is Bayview Oil Corp. and Exploration Surveys, Inc. 1 H. C. Gilmore, 4 miles south of Alco field. On an 8-hour production test, the well flowed 33 bbl. of 43°-gravity oil an hour through 14/64-in. choke, for a calculated daily rate of 796 bbl. Gas-oil ratio was 600:1. Flowing pressure was 720 psi. Top of the Mississippian pay was 4,588 ft., on elevation of 1,105 ft. Perforations for completion were at 4,588-4,611 ft. Total depth was 4,650 ft.

The 1 Gilmore is in the George Dedrick Survey, A-75, 12 miles south of Graham. The two firms are said to hold approximately 1,000 acres under lease surrounding the discovery.

Young County prospect . . . Edwards & Herring Drilling Co. and Georesearch, Inc. 1 Harty "B" last week was ready for completion as a conglomerate gas discovery in southeastern Young County.

Drill-stem tests in the Marble Falls conglomerate at 4,014-28 ft. made an estimated 3,500 M.c.f.d. under flowing pressure of 850 psi. Recovery in the pipe following the test was an unestimated amount of condensate.

Another test, also in the conglomerate at 4,014-50 ft., rated 10 M.M.c.f.d., with no fluid recovery. Flowing pressure reached 1,150 psi., and increased to 1,960 psi. when shut in.

West German exploration shows good results

EXPLORATION for oil in West Germany in 1958 netted significant finds with 65.7% of all wells drilled finding oil or gas. Drilling footage rose from 772,166 m. in 1957 to 782,274 m. in 1958. There were 534 wells drilled in 1958, 351 of them successfully producing.

Center of most drilling activity was in the Hanover area. This section of northern Germany recorded 228,000 m. of hole, followed by the Weser-Ems area with 195,000 m., the Upper Rhine Valley with 121,000 m., Bavaria with 95,000 m., the Emsland with 83,000 m., and Holstein - Hamburg with 54,000 m.

The chart demonstrates the drilling activity in West Germany in 1958 in meters.

Production rose . . . As a result of last year's drilling pickup in West Germany, crude-oil production rose from 28,696,000 bbl. in 1957 to 32,116,000 bbl. in 1958, an increase of 11.9%.

Annual production figures of the main oil-producing areas in the country are shown in the table.

PRODUCTION IN WEST GERMANY
(In thousands of barrels)

	1958	Per cent of total	1957	Per cent of total
Hanover (between Elbe and Weser)	11,151	34.7	9,784	34.1
West of the Ems (Emsland)	9,301	28.9	8,990	31.3
Weser-Ems	6,896	21.5	5,625	19.6
Holstein-Hamburg	3,242	10.1	3,207	11.2
Upper Rhine Valley	1,082	3.4	858	3.0
Bavaria	444	1.4	232	0.8
Total	32,116	100.0	28,696	100.0

Source: "Petroleum Producers Association," Hanover, through the U. S. Department of State, and Bureau of Mines.

Second well confirms new Wilcox discovery

Recent discovery by Oil Reserves Corp. of gas-condensate production in a deep test 3 miles northeast of Bon Weir, in Newton County, southeastern Texas, is being confirmed in the operator's second well.

The confirmation producer, 2-K Kirby-Winfrey, is rated good for 14,250 M.c.f. of gas daily from the discovery well's Wilcox pay, perforated

at 10,568-74 ft. Its 59.2°-gravity condensate recovery is at the rate of 85.33 bbl. per 1,000 M.c.f.

Discovery well, 1 Lindsey, is 1,778 ft. southeast. It was completed last May with a potential flow of 15,000 M.c.f. of gas daily with perforations at 10,590-96 ft.

The new area, designated as Quicksand Creek field, is on the far east side of the county, near the Louisiana line (Sabine River), 3 miles southwest of the two-state Merryville field.

A NEW gas-condensate discovery is assured for northeastern Midland County, Texas, with potential comparable to wells in the Azalea area to the south. Texas Pacific Coal & Oil Co. 1-B McAlister reported good flows from two formations.

Two-pay prospect for Midland County

The search for pre-Pennsylvanian oil in northeastern Midland County, West Texas, has resulted in a sizable Devonian gas-condensate discovery. The well also flowed gas and condensate from the Pennsylvanian Strawn section.

The two-pay opener is Texas Pacific Coal & Oil Co. 1-B O. H. McAlister, Section 41, Block 37, Township 1 South, T&P Survey. It is 2 miles southeast of the town of Germania, and 1½ miles southwest of the same firm's 1 Germania, discovery and lone producer in Germania-Devonian field.

On production test of the Devonian through perforations at 11,368-11,432 ft., 1-B McAlister flowed 335.5 bbl. of 54° condensate in 21 hours through 17/64-in. choke. Gas volume on the same test was at the rate of 1,508 M.c.f.d. Operators shut the well in to build storage tanks. Total depth is 11,548 ft. Top of the Devonian is 11,338 ft.

Production from the Pennsylvanian-Strawn was assured when the well flowed gas at the rate of 454 M.c.f.d., plus 34 bbl. of 57° condensate.

Giraud Unit test is new East Texas pay prospect

A 1-mile east extension attempt at Pan American Petroleum Corp.'s Giraud field discovery in Cass County, East Texas, reported good shows from the Travis Peak.

Pan American 1 Shelton ran a drill-stem test in the Travis Peak at 6,934-50 ft. Gas surfaced in 42 minutes, but was not gaged. Recovery was 630 ft. of 36° oil and 30 ft. of heavily oil-cut mud. Drilling then continued, to test the Cotton Valley, expected around 10,000 ft.

In May of this year, Pan American completed 1 Earl Giraud Unit from three separate zones in the Cotton Valley formation. Tests prior to completion showed a daily potential of over 500 bbl. from the three pay sections.

During drilling of the Giraud well, Pan American logged an interval in or near the Travis Peak that had several potentially oil-productive zones. However, all were heavily water-saturated, according to the log findings.

The Travis Peak interval in the Shelton test is believed to be upstructure from that logged in the Giraud.

Pan American holds full interest in both wells and in an 8,300-acre block in the area. The wells are 5 miles southeast of Linden and 5 miles northwest of Kildare field. Production at Kildare is from the Glen Rose and Pettet zones.

Discovery is assured in Coleman County test

A wildcat 2½ miles south of Goldsboro in Coleman County, West Central Texas, reported recovery of oil, gas and condensate on drill-stem tests in two sections of the Gray sand.

The well is Jake L. Hamon and Roy Guffey 1 Fred Paddleford, in Subdivision 3, H. Kigans Survey 520. Operators drilled to 3,951 ft., then set 4½-in. production pipe on bottom.

Drill-stem test in Gray sand at 3,886-3,920 ft., gas surfaced in 2 minutes, with volume estimated at 1 M.M.c.f.d. Fluid surfaced in 5 minutes, being a spray of oil and a flow of salt water. Recovery from the test was 135 ft. of clean oil, 240 ft. of heavily oil and gas-cut salt water, and 280 ft. of clear salt water. Flowing pressure ranged from 915-1,055 psi., and 1,400 psi. when shut in.

A 2-hour test was run in Gray sand at 3,878-98 ft. Gas surfaced in 2 minutes, in volume that was estimated at 2,700 M.c.f.d. of dry gas. Recovery was 2 gal. of condensate. Flowing pressure ranged from 305-640 psi., and 1,405 psi. when shut in. Open-flow potential on this section was estimated at 9 M.M.c.f.d.

An earlier test that netted only light gas shows was in an unidentified section at 3,435-75 ft. Open 1 hour, recovery was 20 ft. of very slightly gas-cut mud. Maximum flowing pressure was 120 psi., increasing to 540 psi. when shut in 15 minutes.

No. 1 Paddleford is 1½ miles southeast of the Goldsboro field and a half mile east of the old Jim Ned-3,900-ft. area.

Discovery wells

ARKANSAS

Cleburne County: Beard Oil Co. 1 Evans, 32-9n-11w, 1 mile southeast of Quitman. Calculated open-flow potential 430 M.c.f.d., dry gas, perf. 1,956-98 ft., Atoka. TD 3,868 ft. Discovery well Quitman field.

Lafayette County: Coulston Drilling Co. 2 Cornelius Estate, 31-16s-23w, 1 mile east of Kress City field. IP 264 BOPD, ¼-in., 40°, TP 325 psi., perf. 8,218-29 ft., Cotton Valley-Ford sand. TD 8,234 ft. Discovery well East Kress City field.

Union County: Caddo Oil Co., Inc., 1-D Olin, 19-18s-12w, 1½ miles northwest of Strong. Calculated open-flow potential 1,050 M.c.f.d., dry gas, perf. 2,304-28 ft., Nacatoch. TD 2,547 ft. Discovery well North Strong field.

W. R. Wood, Jr., 3 Olin-Sinclair, 18-17s-11w, 1 mile southwest of Benjamin Lake. IPP 10 BOPD (net), 18°, 95% water, perf. 2,549-53 ft., Meakin sand. TD 2,579 ft. Discovery well Banjamin Lake field.

CALIFORNIA

San Joaquin County: Porter Sesnon et al 76-16 Boltzen-Hunter, NE SE 16-3s-6e, IPF 7.5 M.c.f.d., perfs. 4,940-54 ft., TD 5,067 ft., plugged back to 4,954 ft. (First production from Tracy sand in Vernalis field).

WESTERN CANADA

Alberta: Saxet 6-17-13-1 Medicine Hat, LSD 6, 17-13-1w4. Medicine Hat gas well. TD 1,656 ft.

Kidd 11-16-15-13 Rolling Hills, LSD 11, 16-15-13w4. Basal Colorado gas well. TD 3,317 ft.

ILLINOIS

Edwards County: National Associated 1 Phillips Hallam, NE NE SW 26-2s-10e. IPP 24 BOPD, Rosiclare 3,224-30 ft. TD 3,350 ft. Extension to East Ellery.

Jefferson County: Roy Powers 1 Jefferson O&G, NE NE SE 22-4s-2e. IP 6 BOPD, 24 BWPD, Salem 3,230-36 ft. TD 3,257 ft. Extension to Iva field and new pay.

Marion County: National Associated 1 Kalberkamp, NW NE NW 30-1n-1e. IP 45 BOPD, 250 BWPD, Silurian 3,012-27 ft. TD 3,044 ft. New pay discovery.

Clay County: Shulman Bros. 1 Richard Barnett, SE SE NE 6-2n-7e. IPP 112 BOPD, 30 BWPD, Aux Vases 2,972-86 ft. TD 3,110 ft. Extension to South Standord.

KANSAS

Barton County: Central Commercial 1 Karst, NE SE SW 12-16s-15w. IP 107 BOPD, 39% water, 42°, Lansing-Kansas City 3,186-93 ft., Arbuckle (SWD) 3,416-39 ft. TD 3,439 ft. East Galatia field discovery.

Hellar Drilling Co. 1 Hlavaty, SW NE SE 31-17s-14w. IP 195 BOPD, 41°,

first again!

WITH ANOTHER NEW TESTING TECHNIQUE

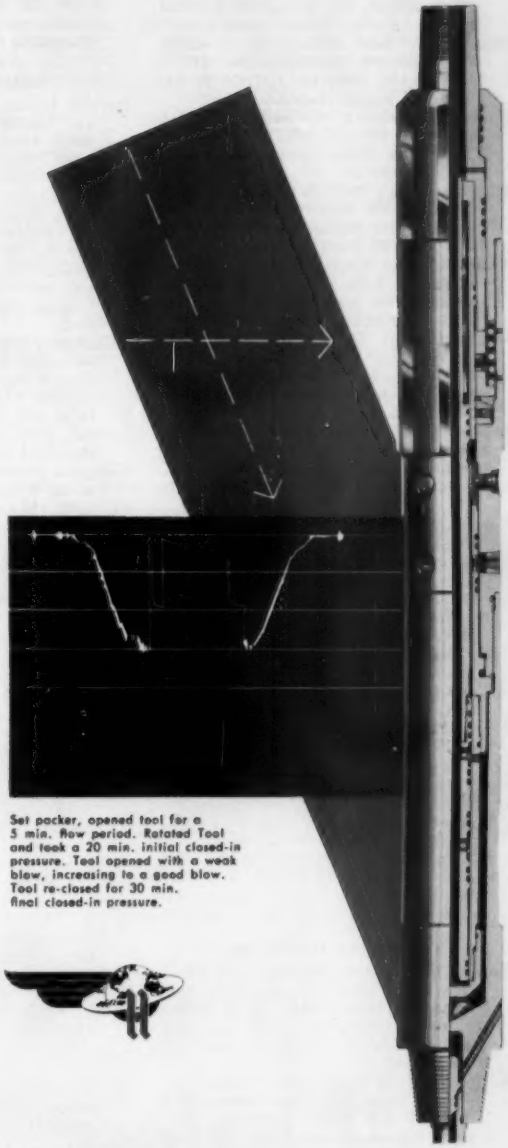
More accurate reservoir evaluation through improved dual closed-in pressure techniques *without air chamber calculations* . . . that's the big testing benefit provided by the new Halliburton Dual Closed-In Pressure Valve. By eliminating the air chamber and the calculations previously required, this new tool results in a higher percentage of usable initial CIP for a better evaluation of your well's potential.

The design of the valve arrangement provides for closing in the formation for both initial and final CIP pressure periods and affords communication from the annulus to the drill pipe for reverse circulation after the test is completed. The Dual CIP Valve is assembled in the test string immediately above the Hydro-Spring Tester.

30 SECOND TECHNICAL DESCRIPTION

The tool incorporates a five-position sliding type valve—with spaced "O" rings moving past ports in the sleeve—actuated through a coarse left-hand thread mechanism by right-hand drill pipe rotation. The valve is locked against premature rotation by the jaw clutch held in place by the spring. The differential area of the design permits disengagement only when sufficient drill pipe weight is applied. Greater safety results, as the clutch is in the locked position while going in the hole.

After the desired interval for initial flow, the Dual Closed-In Pressure Valve is closed by rotation of the drill pipe 11 turns to the right for the initial closed-in pressure period. At the end of this initial period, the valve is opened by 14 additional turns to the right for the second flow interval of the test; then, at its conclusion, 14 more turns (right-hand rotation) again closes the valve for the final closed-in pressure interval after 16 additional right-hand turns.



Set packer, opened tool for a 5 min. flow period. Rotated Tool and took a 20 min. initial closed-in pressure. Tool opened with a weak blow, increasing to a good blow. Tool re-closed for 30 min. final closed-in pressure.

Halliburton's Dual CIP Technique provides important data for the determination of static formation pressure, effective permeability of the tested zone, skin effect or damage factor, and production indices on flowing wells. *Now! the new Halliburton Dual Closed-In Pressure Valve helps to give you even more accurate reservoir evaluation information.* For your next formation test, call Halliburton—first!

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Lansing-Kansas City 3,175-78 ft. TD 3,444 ft. Discovery of Hlavaty field.

Musgrove 1 Adams, SW SW NE 21-20s-13w. IP 265 BOPD, 30.5°, Lansing-Kansas City 3,284-3,332 ft. TD 3,588 ft. North Sandrock field discovery.

Barber County: Champlin Refining Co. 1 Davis Ranch Unit 1, C NE¼ 32-33s-14w. IP 7,200 M.c.f.d., 8 BOPD, Mississippian 4,656-96 ft. TD 4,730 ft.

Cowley County: Musgrove 1 Smith, 15-25s-14w. IP 149 BOPD, 34°, Lansing-Kansas City 3,803-13 ft. TD 4,280 ft.

J. D. White 1 Mosier, NE NE NW 29-34s-6e. IP 8 BOPD, 38°, Mississippian 3,138-46 ft. TD 3,188 ft.

King et al. 1 Lovell, SE SE SW 9-35s-3e. IP 64 BOPD, 40°, Bartlesville 3,460-64 ft. TD 3,903 ft. Opens Lovell pool.

Ellis County: B&B Drilling Co. 1 Kaiser "B," NW SW SE 30-13s-20w. IP 70 BOPD, 41°, Arbuckle 3,921-26 ft. TD 3,926 ft. Kaiser discovery.

Edwards County: L. C. Smitherman 1-A Henshaw, SW SW NE 34-25s-16w. IP 29 BOPD, Conglomerate, 4,394-4,435 ft. TD 4,469 ft.

Kingman County: Drillers Producers 1 Lock "B," C NW NW 13-30s-7w. IP 40 BOPD, 33°, Mississippian 4,124-33 ft. TD 4,133 ft. Lock discovery.

Kiowa County: Rupp-Ferguson 1 Parkin, C SE NW 8-30s-18w. IP 2,000 M.c.f.d., Mississippian 4,996-5,010 ft. TD 5,115 ft. South Nichols field discovery.

Meade County: Skelly Oil Co. 1 Flora Baragree, C NW SE 25-34s-28w. IP 13,434 M.c.f.d., Council Grove 3,066-3,081 ft., 3,094-3,106 ft. TD 6,220 ft. New field.

Morton County: Panhandle Eastern Pipeline Co. 1-21 Berryman "B", 880 M.c.f.d., Wabaunsee 2,849-51 ft., 2,862-64 ft., 2,869-71 ft., 2,897-99 ft. TD 5,450 ft.

Rawlins County: Skelly 1 A. S. Cahoj, SE SE NE 17-1s-34w. IPF 910 BOPD, Lansing-Kansas City 4,052-4,277 ft. TD 4,732 ft. New field. Cahoj.

Sheridan County: Imperial Oil of Kansas 1 Pratt Estate, C NW SE 27-8s-26w. IP 30 BOPD, Lansing-Kansas City 3,786-88 ft., 27°. TD 3,970 ft. South Studley discovery.

Saline County: Pearl B. Jackson 1 Gillbert, SW NW SE 28-14s-2w. IP 166 BOPD, 33.3°. Maquoketa dolomite 3,223-31 ft. TD 3,446 ft. Gillberg field discovery.

Stafford County: Tomlinson-Kathol, Inc. 1 Laudick, SE SE NW 16-21s-14w. IP 10 BOPD, 32°, 3,720-24 ft. TD 3,795 ft. West Taylor discovery.

Petroleum, Inc. 1 Belete, NE NE SW 32-24s-13w. IP 330 BOPD, 31°, Lansing-Kansas City 3,842-52 ft. TD 4,285 ft.

LOUISIANA OFFSHORE

Eugene Island Area: Pan American Petroleum Co. 1 OCS-0575, Block 207, Gulf of Mexico. IP 1,200 M.c.f.d., 80 BCPD, 11/64-in., 50.6°, TP 4,200 psi., perf. 12,552-60 ft. TD 13,458 ft. New offshore field.

Southwest Marsh Island Area: Texaco, Inc., 4 State Lease 340—Tiger Shoal—OCS-0310. IP 231 BOPD, 10/64-in., 35.6°, GOR 639 cu. ft. per barrel, TP 1,100 psi., perf. 12,008-17 ft. TD 13,742 ft. New pay and extension Tiger Shoal field.

NORTH LOUISIANA

Catahoula Parish: A. J. Hodges, Jr., et al. 1 Urania, 5-9n-6e. IP 160 BOPD, 12/64-in., 39°, GOR 350 cu. ft. per barrel, TP 225 psi., perf. 4,127-29 ft., Wilcox. TD 4,232 ft. New field discovery.

Concordia Parish: R. A. Campbell 1 Dale, 36-7n-7e, 2½ miles southeast of Black Lake. IP 55 BOPD, 12/64-in., 36.5°, TP 100 psi., perf. 5,245-46½ ft., Wilcox. TD 6,002 ft. Discovery well North Horseshoe Lake field.

Lincoln Parish: Atlantic Refining Co. 1 Hattie Price, 7-18n-3w, 2½ miles north of Grambling. IP 2,170 M.c.f.d. daily, 150 BCPD, 16/64-in., 58.3°, TP 1,620 psi., perf. 9,936-44 ft., Cotton Valley. TD 10,310 ft. Extends Ruston field.

Richland Parish: Ben D. Marks 1 Baker et al., 33-16n-7e, 1 mile northeast of Mangham. IP 66 BOPD, 9/64-in., 38.9°, TP 180 psi. perf. 3,270-78 ft., Tuscaloosa. TD 3,326 ft. Discovery well Mangham field.

SOUTH LOUISIANA

Iberville Parish: Republic Natural Gas Co. and Sinclair Oil & Gas Co. 1 Opdenweyer-Alcus Cypress. IP 216 BCPD, 1,388 M.c.f.d., 57.2°, TP 3,590 psi., perf. 11,225-36 ft. TD 11,350 ft. New pay and extension in St. Gabriel area.

St. James Parish: Union Oil & Gas Corp. of Louisiana 1-B Miles Timber, 21-13s-17e, IP 72 BOPD, 6/64-in., 35°, GOR 5,550 cu. ft. per barrel, TP 3,300 psi., perf. 11,389-98 ft. TD 11,870 ft. Extends Chegby field 1¼ miles northeast.

Lafourche Parish: Sinclair Oil & Gas Co. 1 Salvadore Segretto, 38-15s-17e, 4 miles east of Rousseau, field. IP 177 BOPD (net), 45% b.s. and w., 6/64-in., 40.9°, GOR 887 cu. ft. per barrel, TP 6,800 psi., perf. 14,486-97 ft. TD 15,010-ft. New-field discovery.

Vermilion Parish: Southern Crude Oil Co. et al, 1 Louis Maynard, 7-14s-3e. IP 1,980 M.c.f.d., 28 BCPD, adjustable choke, 45.7°, TP 4,100 psi., perf. 12,-160-64 ft. TD 12,456 ft. New reservoir discovery 1¼ mile south of Theall field.

NEW MEXICO

Eddy County: Texaco, Inc. 1 Heflin-Federal, 24-24s-31e, 20 miles east of Malaga. IPP 25 BOPD, 34°, GOR 900:1, Canyon 7,184-7,200 ft. TD 8,545 ft., PB 7,325 ft. ground elevation 3,538 ft.

Lea County: Amerada Petroleum Corp. 1-Q State, 16-20s-37e. IP 77.7 BOPD, 35°, GOR 828:1, Tubb 6,455-6,508 ft.; IP 38.6 BOPD, ½-in. choke, 36°, Grayburg 3,750-3,770 ft. Recompletion. Old TD 3,870 ft., new TD 6,938 ft.

Continental Oil Co. 1 Tonto Deep Unit, 22-18s-34e, 15 miles southeast of Maljamar. IP 121 BOPD, ¾-in. choke, 44°, GOR 41:1, TP 20 psi., Wolfcamp perforations 11,396-423 ft. TD 14,925 ft., PB 11,600 ft.

McAlester Fuel Co. and Texas Crude Oil Co. 1 HN-State, 16-11s-33e, 7 miles southeast of Caprock. IP 304 BOPD, 30/64-in. choke, GOR 980:1, TP 150-225 psi., Pennsylvanian 10,744-70 ft. TD 11,607 ft., elevation 4,296 ft.

OKLAHOMA

Beaver County: Statex Petroleum Corp. 1 Nelson, C NW SE 27-1n-24eCM. IP 3,310 M.c.f.d., Tonkawa 6,120-6,222 ft. TD 6,222 ft. New field.

El Paso 1 Oklahoma-Schneider, 36-1n-26eCM. IP 4,800 M.c.f.d., Morrow 8,524-60 ft. TD 8,950 ft. New field.

Mountain States Petroleum Co. 1 Blakemore, NW SE SE 9-4n-21eCM. IP 2,400 M.c.f.d., Chester 6,508-14 ft., 6,524-29 ft., 6,589-93 ft., 6,600-04 ft. TD 6,710 ft. New field.

Cleveland County: Lone Star Producing Co. 1 Southland Royalty Co., C SE NE 26-9n-2w. IP 45 BOPD, 15 BWPD, 32°, Viola 7,280-7,362 ft. TD 8,450 ft.

Dewey County: Union Oil Co. of California 1 Irwin, C SE NW 10-16n-17w. IP 4,700 M.c.f.d., Morrow sand 11,211-42 ft. TD 12,512 ft. Shut-in gas discovery.

Grant County: Woods Petroleum Corp. 1 Hein, C SE NE 14-27n-6w. IP 14,962 M.c.f.d., 7 BOPD, 50°, Red Fork 4,839½-94 ft. TD 5,001 ft.

Harper County: An-Son Petroleum Co. 1 Bender, C NW SE 7-28n-22w. IPF 5,743 M.c.f.d., Viola 7,260-70 ft., Arbuckle 7,660-80 ft. TD 7,776 ft. New pay in North Buffalo field.

Phillips Petroleum Co. 1 Complete, 36-28n-21w. IP 80 BOPD, Cherokee 5,765-5,800 ft., 5,828-38 ft. TD 7,112 ft. New pay in North Lovesdale field.

Kingfisher County: Calvert Drilling Co. and King Stevenson 1 Perdue, C NW SE 23-17n-7w. IP (not reported), Oswego 6,787-89 ft., 6,795-6,801 ft., 6,806-15 ft. TD 8,035 ft. Northeast Dunlap discovery.

McClain County: Sunray Mid-Continent 1 Glasco-Porter, 1-5n-3w. IP 63 BOPD, 42°, Harton 7,562-68 ft., Hunton 7,830-36 ft. TD 7,890 ft.

Pure Oil Co. 1 S. K. Dyer, C S½ NE NW 23-7n-2w. IPP 203 BOPD, 38.4°, Marshall 7,784-7,803 ft. TD 8,700 ft. North Purcell outpost.

Murray County: Falcon-Seaboard Drilling Co. 1 Fisher, SE NE NE 12-1s-2e. IP 52 BOPD, 85 BWPD, 25°, basal McLish 2,848-57 ft. TD 3,971 ft.

Stephens County: Ada Oil Co. 1 Edgar Poe Hiers, SE SE SW 5-3s-4w. IPP 18.7 BOPD, 29.7°, Loco 1,096-1,159 ft. TD 6,154 ft.

Texas County: Phillips 2 Muss, C NE SW 16-1n-14eCM. IP 154 BOPD, 34.5°, Cherokee 6,021-34 ft. TD 8,415 ft. New pool.

Republic Natural Gas Co. 3 Blake, C SE NW 11-5n-13eCM. IP 240 BOPD, 41°, Morrow 6,112-34 ft. TD 5,848 ft.

Hamon and Peerless 1 Elmore, 1,150 M.c.f.d., Chester 6,528-55 ft. TD 6,814 ft. New field.

EAST TEXAS

Anderson County: Pan American Petroleum Corp. 1 Giraud Gas Unit, George S. Young Sur., A-1161, 4½ miles southeast of Linden. IP 281 BOPD, 8/64-in. choke, TP 225 psi., GOR 426:1, 48.8°, Cotton Valley limestone 10,620-63 ft.; IP 45 BOPD, 24/64-in. choke, GOR 916:1, 43°, TP 15 psi., Cotton Valley 10,254-62, 10,278-83 ft.; IP 129 BOPD, 14/64-in. choke, CP 300 psi., GOR 476:1, 51.9°, Cotton Valley 9,864-74, 9,951-58 ft. TD 12,077 ft., elevation 347 ft. Discovery of East Linden field.

Hill County: McKenzie Bros. Oil & Gas Co. 1 Charles Vosburg, F. N. Scrutchfield Sur., 3½ miles west of Hubbard. IPP 32 BOPD, 19°, Woodbine 1,160-61 ft. TD 1,161 ft. Discovery of Hubbard field.

Limestone County: W. R. Hughey et al. 1 F. D. Connell, Joseph Ferguson Sur., A-194, 3 miles south of Oletha. IP 37 M.M.c.f.d., Rodessa 6,692-6,736 ft., GLR 35,700:1, 53.2°, shut-in casing pressure 2,720 psi.; IP 2,450 M.c.f.d., Pettet 7,256-76 ft., GLR 58,800:1, 58°, shut-in tubing pressure 2,734 psi. TD 7,605 ft., elevation 422 ft. Discovery of Southwest Oletha field.

Marion County: Whelan Bros. 1 Mary Torrans, Joseph J. Ward Sur., A-382, 3½ miles southeast of Lassiter. IPP 32 BOPD, 39°, GOR 104:1, Pettet 7,210-19, 7,228-39 ft. Old TD 7,619 ft. Recompletion.

NORTH TEXAS

Jack County: Parmer & Hudspeth 1 Lon Campsey, J. M. Hudson Sur., A-310, 10 miles north of Jackboro. IPP 87 BOPD 41°, GOR 800:1, conglomerate 5,426-40 ft. TD 5,494 ft., ground elevation 1,028 ft.

Wilbarger County: Tom B. Medders and Gulf Oil Corp. 1 Ancell "B," Sec. 34, Blk. 6, H&TC Sur., 1½ miles south of Consolidated field. IP 198 BOPD, 43°, GOR 550:1, TP 240 psi., Ellenburger 4,482 ft. TD 4,495 ft., ground elevation 1,110 ft.

SOUTHWEST TEXAS

Dimmit County: Michel T. Halbouty 4 Robert Shook et al., Section 29, Block 113, I&GN Sur., A-903, 8 miles southwest of Carrizo Springs. AOF 1,500 M.c.f.d., dry gas, shut-in TP 936 psi., perf. 2,984-95 ft., Navarro-Olmos. TD 3,600 ft. New-reservoir discovery in Celeste-Fay—Straus Area.

Starr County: Wood Brothers & Langham 1-B Arcadio Guerra et al., Block G, O. G. Woods Subd., Share 6, San Jose Grant, 1 mile north of La Reforma. IP 154 BOPD, 10/64-in., 49.8°, GOR 2,550 cu. ft. per barrel, TP 1,370 psi., Frio. TD 5,815 ft. New-field discovery.

W. B. Osborne 6 Fee, Share 1, Los Retaches Grant, 1 mile southwest Santa Elena. IP 47 BOPD (net), 20% water, 46°, GOR 1,198 cu. ft. per barrel, perf. 5,190-98 ft., Frio. TD 5,750 ft. New oil pay in North Sun field.

TEXAS PANHANDLE

Carson County: Cities Service Oil Co. 1 Burnett-Ranch "E-100," Sec. 100, Blk. 5, I&GN Sur., 6 miles southwest of Borger. IPP 121 BOPD, 40.5°, White dolomite 2,995-3,089 ft. TD 3,215 ft. Oil discovery.

Lipscomb County: Amtex Oil Corp. 1 Hildenbrand, Sec. 516, Blk. 43, H&TC Sur., 4 miles southeast of Lipscomb, south-central part of county, 3½ miles southeast of Piper Morrow oil field, 2½ miles southwest of Des Moines gas production in Lipscomb field. IPCAOF 2,500 M.c.f.d., Cleveland 7,966-76 ft. TD 10,705 ft. Gas discovery.

Texaco, Inc. 1 Anna Frass "C," Sec. 106, Blk 10, HT&B Sur., 16 miles north of Lipscomb, 1¼ miles southwest of Frass Atoka field, 1¼ miles southwest of Frass Tonkawa field. IPCAOF 4,350 M.c.f.d., Morrow 8,800-22 ft. TD 9,100 ft. Gas discovery.

Ochiltree County: Sinclair Oil & Gas Co. 2 G. F. Buzzard, Sec. 75, Blk. 13, T&NO Sur., 9 miles southeast of Farnsworth. IPCAOF 3,100 M.c.f.d., Buckhaultz sand 8,280-85 ft. Gas discovery.

Apache Production Corp. 1 Hartman, Sec. 394, Blk. 43, H&TC Sur., 16 miles south of Perryton in south-central part of county, 2 miles northeast of Turner Lower Morrow gas field, 3¾ miles southwest of Turner Morrow oil field. IPCAOF 12,000 M.c.f.d. and 30 BCPD, lower Morrow 9,313-23 ft. TD 9,620 ft. Gas-condensate discovery.

WEST CENTRAL TEXAS

Throckmorton County: Carter-Gifford 1 Walker-Bucker Trust Fee, Sec. 693, TE&L Sur., 4 miles west of Woodson. IP 137 BOPD, 10/64-in. choke, 40°, GOR 360:1, TP 400 psi., Atoka 4,451-57, 4,463-67 ft. TD 4,616 ft., elevation 1,249 ft.

WEST TEXAS

Andrews County: Anderson-Pritchard Oil Corp. 2-G University, Sec. 1, Blk. 8, PSL Sur., 16 miles east of Andrews. IPP 31 BOPD, 37°, GOR 300:1, Dean sand 9,595-9,720 ft. Recompletion. Old TD 12,559 ft., PB 9,721 ft. New pay in Prichard-Devonian field.

Crockett County: J. H. Buchanan 1 C. W. Meadows "C," Sec. 40, Blk. GG, HE&WT Sur., 10 miles northeast of Sheffield. IPP 42 BOPD, 32°, San Andres 1,744-68 ft. TD 2,005 ft., elevation 2,304 ft.

Garza County: Alamo Corp. 1 G. D. Eillis, Sec. 1304, J. Hays Sur., 11 miles northwest of post. IPP 4 BOPD, 36°, San Andres 3,232-52 ft. TD 4,344 ft., elevation 2,672 ft.

Hockley County: Big Spring Exploration, Inc. 1 Lawson, Labor 31, League 74, Haskell CSL Sur., 10 miles northwest of Levelland. IPP 185 BOPD, 32°, GOR 250:1, San Andres 4,711-27, 4,738-44 ft. TD 4,746 ft., ground elevation 3,592 ft.

King County: Pan American Petroleum Corp. 16 Masterson, Sec. 41, AB&M Sur., 17 miles northeast of Guthrie. IP 900 M.c.f.d., Bend conglomerate 5,710-20 ft. TD 5,723 ft.

Jake L. Hamon and Roy Guffey 1 Hendrix, Sec. 87, Blk. 13, H&TC Sur., 21 miles southeast of Guthrie. IPP 52 BOPD, 34°, GOR 275:1, Pennsylvanian 5,244-47, 5,237-41 ft. TD 5,300 ft., ground elevation 1,550 ft.

Loving County: Delfern Oil Co. 1 Anderson, Sec. 45, Blk. 29, PSL Sur., 7 miles east of Mentone. IP 31 BOPD, 24/64-in. choke, 37°, GOR 850:1, TP 50 psi., Delaware 4,929-30 ft. TD 5,045 ft., ground elevation 2,764 ft.

Pecos County: Standard Oil Co. of Texas 2 Hellon Hokit "2," Sec. 15, Blk. 127, T&STL Sur., 15 miles southwest of Bakersfield, 3½ miles southeast of Hokit-Penn. field. IPP 10 BOPD, 24°, Queen 2,567-90 ft. TD 2,679 ft.

Runnels County: Horace E. White 2 Ralph Parker, A. Jett Sur. 530-4/8, 6 miles north of Ballinger. IPP 77 BOPD, 45°, GOR 500:1, pay 2,414-19 ft. TD 2,622 ft.

Horace E. White 3 Parker, T. T. Williamson Sur. 529, 6 miles north of Ballinger. IP 133 BOPD, ¼-in. choke, 44.5°, GOR 200:1, TP 70 psi., pay 2,573 ft. TD 2,578 ft.

Rich & Jobst 1 Fayerman, J. W. Taylor Sur. 2, 4½ miles south of Winters, ½ mile southwest of Winters field. IP 116 BOPD, 10/64-in. choke, 40°, GOR 970:1, TP 540 psi., pay 4,119-29 ft. TD 4,515 ft. New pay discovery.

Sutton County: Saturn Drilling Co. 1 Frank Warren, Sec. 83, Blk. A, GWT&P Sur., 29 miles southeast of Sonora, 3 miles southwest of Ken field. IP 43 BOPD, 16/64-in. choke, 32°, GOR 1820:1, TP 450 psi., Strawn 2,770-86 ft. TD 2,835 ft.

Upton County: Gulf Oil Corp. 1 J. T. Brown, Sec. 8, Blk. 41, T5S, T&P Sur., 14 miles northeast of Crane. IP 2 M.M.c.f.d., Wolfcamp 9,885-9,936 ft. TD 10,590 ft., ground elevation 2,683 ft. New pay in Davis-Ellenburger field.

Ward County: Gulf Oil Corp. 44 W. A. Estes, Sec. 22, Blk. B-19, PSL Sur., 7 miles southwest of Monahans. IP 1,270 BOPD, ½-in. choke, 37°, GOR 1317:1, TP 700 psi., Pennsylvanian 7,880-7,940 ft. TD 12,980 ft., PB 8,099 ft. Ground elevation 2,573 ft.

Yoakum County: Pan American Petroleum Corp. 1 Fitzgerald, Sec. 430, Blk. D, John H. Gibson Sur., 2 miles east of Plains. IPP 224 BOPD, 42°, GOR 84:1, Wolfcamp 9,262-78 ft. TD 12,670 ft., elevation 3,634 ft.

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√ Seals without excessive tightening of stuffing box nut
√ Unique design provides a definite space for lubrication and cooling
√ Resists abrasion
√ Longer life
√ Proven in field tests
√ All standard sizes available
Made of specially compounded synthetic rubber, which is tough yet resilient, "Red Dog" packings resist abrasion. Distinctive shape provides a tighter seal for leak-proof sealing even in extremely severe environments.
A sample set of Red Dog packing is available on request...send us your stuffing box and rod size.
PACIFIC MOULDED PRODUCTS CO.
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You'll see the difference in their carefully machined seats, the accurately cut Acme threads, the precision machined pipe ends, the deep knurling on the subs that assure safe positive wrenching.

You can't see or feel the rigidly controlled heat treatment but you will know it's there when your WECO Union seats and seals perfectly after hundreds of make-up and break-outs.

Study the design, see how the ball and cone seats always *assure* a positive, full-circle, metal-to-metal seal.

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WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

Odale Not Afraid of Change

• New Shell Pacific Coast production boss helped pioneer unitized rigs and draw works and automatic field devices.

OIL men born in California almost without exception have one common trait: No matter where life's labors take them, they plan to get back to the Golden State eventually.

O. L. Odale, Shell Oil Co.'s new production manager on the Pacific Coast, goes 'em one better.

When Odale left the family farm at Lemoore, Calif., in the late 1920s to pursue an oil career, he not only planned to come back to California some day but he even planned to end up back at the very house he left.

The Odale family property in Lemoore has been retained for nearly 40 years in anticipation of his return.

Meanwhile, both Shell and Uncle Sam have seen to it that he had some fancy returning to do. It would be difficult to find an oil patch in the United States where Odale hasn't at least had a cup of coffee, let alone worked there for a spell.

Decided early . . . Odale decided early in life that he wanted to be a part of the oil business.

His decision was influenced, no doubt, by the existence of huge Kettleman Hills oil field just west of his home town. Normally, one would expect him to start out at Kettleman Hills since it was so close. But about the only association Odale had with it was an occasional wave of the hand while passing by enroute to some more distant oil field.

After deciding that life on the farm was fine for coming back to but not for making one's fortune on, Odale headed for the College of the Pacific. After 2 years at COP, he transferred to Stanford University. There he ended up with a mechanical-engineering degree in 1931. He got his feet wet in the oil business during that time with a summer spell as a roustabout in the Santa Fe Springs field in Los Angeles.

No-so-oldtimers will recall that California in 1931 wasn't exactly a job-seeker's paradise, especially in the oil industry. Odale decided that in the interest of eating regularly, he'd better look elsewhere for a while.

Elsewhere turned out to be the Navy. After flight training at Pensacola, Fla., Odale was commissioned an ensign and assigned to the famous aircraft carrier Lexington.

Following a 2-year service hitch, Odale returned to California where he was signed on as a roustabout for Shell in the Long Beach area. Within a year he had been promoted to the engineering department and transferred to Oilfields, only 30 miles from his old home town.

In 1935, Odale was again promoted and transferred. This time it was to Shell's San Joaquin Valley headquarters at Bakersfield as division engineer. It was while he was working in central California that Odale did considerable early work on unitizing rigs and draw works.

By 1938, his travels began again. He was made senior mechanical engineer in Shell's Houston office. The following year he went up to Midland as division mechanical engineer.

About 2 years later, the unpleasantries in the Pacific took his attention. He was recalled by the Navy where he served with distinction for more than 5 years. His duties included service as air coordinator with Adm. Kelly Turner's amphibious forces. Odale participated in some of the Pacific's fiercest campaigns, including Tinian, Palau, Saipan, Iwo Jima, and Okinawa. He was released from active duty after the war as a commander.

Returned to Shell . . . Following his release, Odale returned to Shell and worked in various capacities both in Texas and in the company's New York offices.

In 1953, he again launched a westward trek by being named general superintendent in Shell's Denver office. The following year he was made production manager at Denver.

During one period of his postwar service with Shell in the East Texas field, he did important work on some of the first automatic field production devices used in the industry.

●

W. R. Cox, district mechanical engineer for Shell Oil Co. in Kilgore, Tex., has been promoted to division construction foreman in the marine division, New Orleans.

Dr. Norman G. Gaylord, formerly assistant director of Interchemical Corp.'s organic chemistry department, has been elected vice president for research and development in the polymer division of Western Petrochemical Corp.

John C. Dunlap, DeGolyer & MacNaughton, has been elected president of the Dallas Geological Society. He succeeds **Norman C. Smith,** photogeological consultant. Other new officers are **Paul W. Foster,** Atlantic Refining Co., first vice president; **Jeff E. Miller, Jr.,** exploration consultant, second vice president; **Ross H. Ley,** Sun Oil Co., secretary; and **Edward L. Hazlewood,** with C. L. Norsworth, Jr., treasurer.

▶▶▶ Personals

Harry E. Keegan, Union Oil Co.'s district foreman in Brea, Calif., has been promoted to Oklahoma division superintendent. He will headquarter in Tulsa. A graduate of the University of California, Keegan joined Union in 1948. He served as reservoir engineer, development engineer, and senior petroleum engineer before becoming Brea district foreman.

R. J. Miller, technical assistant to the manager of chemicals research, development, and technical service at California Research Corp.'s Richmond, Calif., laboratory, has been appointed assistant to the director of the La Habra, Calif., laboratory.

J. L. Nanney, general foreman of the oxo-cracking and catalyst department at Esso Standard Oil Co.'s Baton Rouge refinery, has been named assistant head of the chemical products division. **J. B. Arbour,** head of the mechanical technical service department, succeeds Nanney. **Max Kuniansky,** assistant head of the business analysis department, replaces Arbour.

R. H. Harvey, assistant head of the petroleum products division at Esso Standard Oil Co.'s Baton Rouge refinery, has joined the coordination and petroleum economics department of Standard Oil Co. (N. J.) in New York. **F. G. Turpin,** assistant head of the technical division at Baton Rouge, succeeds Harvey there. **C. B. Moore,** head of the chemical technical service department, replaces Turpin in the technical division. **R. H. McCollister,** assistant head of chemical service, will head the department, succeeding Moore.

J. A. Vickers, president of Vickers Petroleum Co., has moved his headquarters to Denver from Wichita. Exploration, production, and research departments of the company are now headquartered in Denver. Others making the move include **W. K. Jackson,** vice president in charge of research; **A. E. Collins,** production manager; **L. W. Goudy,** assistant exploration manager and chief geologist; **D. S. Ramsay** and **H. F. Fuqua,** geologists; **George Stovall,** chief engineer; and **F. L. Buellesfeld,** attorney.

Robert J. Butler, formerly with American Cyanamid Co., has joined Continental Oil Co. as analyst in the petroleum section, marketing research division.

Clarence A. Nyhof, Shell Oil Co. crude-oil representative in Tulsa, has been transferred to Midland, Tex., in the same capacity.

O. Lewis Smith, staff engineer with Alex McCoy Associates, Inc., in Tulsa, has joined U. S. Mining & Smelting Co. as Rocky Mountain division operations superintendent, oil and gas division. He will headquarter in Denver.

Roland A. Whealy, formerly coordinator of sales and refining for Ashland Oil & Refining Co., has been elected a vice president. Whealy has been on leave of absence since 1958 with the Department of Interior. He served most recently as deputy imports administrator under the oil import administration. He has been with Ashland since 1935.

David Holcomb Scott, formerly with Hancock Oil Co. and Signal Oil & Gas Co., has joined Anglo-Philippine Oil Corp., Manila, on contract as exploration manager. **Daniel Norman Klemme,** formerly with Hancock, has joined Anglo-Philippine as chief geologist. Contracts with the company are for two years, renewable at company option for an additional year. Similar contracts were signed by **Louis Bernard Christian,** geologist, formerly with Standard Oil Co. of California; and **Lawrence Frank Machesky,** geologist, formerly with Standard-Vacuum Oil Co.

SCOTT

KLEMME

T. L. Osborne, Corpus Christi, Tex., district superintendent for Phillips Petroleum Co., has been named superintendent of the production department's Houston district. He will headquarter in Alvin, Tex. Osborne succeeds **R. L. Young,** who has resigned. **G. C. Watson,** senior engineer in the Gulf Coast division, has been promoted to Corpus Christi superintendent, succeeding Osborne.

J. T. Hollis, reservoir geologist and log analyst for Phillips Petroleum Co. in Bartlesville, Okla., has joined H. L. Hunt Oil Co. in Dallas as geologist.

Frank A. Watts, sales manager in Houston for Humble Oil & Refining Co., has retired after 40 years with the company.

W. S. Crake, formerly chief mechanical engineer with Royal Dutch-Shell in The Hague, has been transferred to Houston on special assignment as engineer with Shell Oil Co.

Ben A. Burdette, assistant employe relations manager at Mobil Oil Co.'s Augusta, Kans., refinery, has been appointed mechanical engineering supervisor at Augusta. He succeeds **E. F. Moore.** Burdette was chief project engineer at the refinery before moving to employe relations last year.

Eugene E. Richardson has been appointed senior project chemist at the Whiting, Ind., laboratories of Standard Oil Co. (Ind.). **Benjamin A. Bolton** has been named project chemical engineer at Whiting. **Ivan J. Sitar** has been named project chemical engineer at the company's Seymour, Ind., laboratories.

James E. Dorris, vice president of Seismograph Service Corp. of Venezuela, has been named vice president of Seismograph Service Corp. (International). He will headquarter in Paris. **Frank I. Garrette,** supervisor of continuous velocity logging operations in Venezuela, will succeed Dorris as manager of Venezuelan operations.

Kenneth A. Spencer, president of Spencer Chemical Co., has been elected chairman of the company. He will continue as chief executive officer. **John C. Denton,** vice president in charge of the agricultural chemicals division, will succeed Spencer as president. He has also been elected a director and member of the executive committee. Denton will be chief operating officer of the company. In other changes, **C. Y. Thomas,** formerly general vice president, operations, has been elected vice chairman of the board. **John P. Miller,** general vice president, finance, has been named senior vice president, finance, and **Joe E. Culpepper,** general vice president, marketing, becomes senior vice president, marketing. **Byron M. Kern,** general manager of production for agricultural chemicals, succeeds Denton as vice president in charge of that division.

B. W. Miller, Gulf Oil Corp., has been elected 1959-60 president of the Fort Smith, Ark., Geological Society. He succeeds **Charles S. Bartlett,** also of Gulf. Other new officers are **Fred Mock,** Arkansas Louisiana Gas Co., vice president, and **Roger N. Planalp,** Athletic Mining & Smelting Co., secretary-treasurer.

D. S. Bodie, district superintendent for Cities Service Oil Co. in Columbus, Tex., has been named assistant division superintendent in Oklahoma. He will move to Lindsay, Okla., to work with early-stage organization of the Northeast Purdy unit. Also moving to Lindsay will be **C. T. Kemerling,** Odessa, Tex., as district clerk, and **George L. Goodman,** Columbus, as production foreman. **J. W. Wise,** Lindsay district superintendent, will open a new district production office in Chickasha, Okla. His enlarged district will include Seminole and Walters areas and Cities Service leases outside the Northeast Purdy unit in the Lindsay area. In the Chickasha district **Charles L. Coffman** will be district engineer; **John D. McCutchan,** petroleum engineer; **George E. Rose,** district clerk; and **John B. Dade,** clerk. Oklahoma City and North Oklahoma operations of the company have been consolidated into the Oklahoma City district with **R. L. Higginbottom** as superintendent. **Hugh Riley,** Oklahoma City, is division production superintendent for Cities Service in Oklahoma.

J. J. Wright, superintendent of Service Pipe Line Co.'s Drumright, Okla., district, has been appointed superintendent of the Williston, N. D., district. He succeeds **A. S. Munneke,** who has been transferred to Tulsa to develop and coordinate a

WRIGHT

MUNNEKE

systemwide preventative maintenance program for electrical equipment. **J. W. Cox,** superintendent of the Craig, Colo., district, will succeed Wright in Drumright. Wright has been with Service since 1947. He was division chief engineer in Lubbock, Tex., before moving to Drumright. Munneke had held the Williston post for the past five years.

Clarence L. Armstrong, superintendent at Virden, Man., for Trans-Prairie Pipelines, Ltd., has been appointed assistant general manager for the company. **Russell H. Krumnfusz** has been named superintendent. He was formerly assistant superintendent of the Weyburn, Sask., district. **George B. Lipsett** has been appointed chief engineer.

▶ ▶ ▶ Personals

Joe D. Hargrave, engineer in Liberty, Tex., for Texaco, Inc., has been transferred to Caracas.

William E. Wright, engineer with the Arkansas Oil & Gas Commission, has been named commission geologist in El Dorado, Ark. He succeeds the late Walter L. Dobie.

Gerald L. Mardis, formerly district pipeline superintendent in Refugio, Tex., has been named pipeline superintendent of Coastal Transmission Corp. He succeeds **S. L. Windham,** who was recently promoted to general pipeline superintendent of Coastal and Houston Texas Gas & Oil Corp.

C. E. Rogers, district drilling engineer for Sun Oil Co. in Midland, Tex., has been named district petroleum engineer there. He succeeds **Don C. Brown,** who was recently promoted to assistant to the regional superintendent in Dallas. Brown had held the Midland post since 1952.

J. R. Weyler, chief southwestern division production engineer for Pure Oil Co. in Tulsa, has been promoted to assistant to the southwestern division manager. He succeeds **Charles W. Hancock,** who has formed Charles W. Hancock & Associates, Inc., Dallas consulting firm. Hancock had been with Pure since 1949.

▶ ▶ ▶ Deaths

Harry Oliver Cameron, 89, retired assistant secretary and assistant to the manufacturing and production vice presidents of Sun Oil Co., died July 29 in a Toledo hospital. Cameron joined Sun in 1904 and retired in 1955. He was at one time manager of the company's Yale, Okla., and Toledo refineries and manager of the Michigan production division. He was named assistant to the manufacturing and production vice presidents in 1944.

Stanley A. Brander, Sr., 56, president of Pioneer Corp., Tulsa producing firm, died August 4 in a Los Angeles hospital. He had been ill since arriving in Los Angeles on vacation the preceding week. A graduate of Lombard College, Galesburg, Ill., Brander had been president of Pioneer since 1938.

George Dewey Hayes, 51, Jackson, Miss., independent, died July 31 in Jackson after an illness of several months. Hayes was active in the El Dorado, Ark., area at one time. His operations had centered in Mississippi fields since the early 1940's.

Jack Frazier, 68, Texas independent operator and pioneer wildcatter, died August 4 in a Houston hospital of cancer. Frazier was credited with 18 major discoveries or field extensions. His first major discovery was Hardin field in Liberty County, Texas, in 1935. This was followed by West Hardin, Eureka Heights, Mount Houston, and Southwest Hardin. He was one of the group of wildcatters whose successes in the 1930's made the Texas Gulf Coast an area untouched by the depression.

Arthur L. Wasson, 89, Big Spring, Tex., operator for whom Texas' Wasson pool was named, died July 30 in Big Spring.

Neil C. Needham, 70, retired chief of General Petroleum Corp.'s land and lease department, died July 27. Needham retired in 1949 after 38 years with the company.

Frank W. Officer, 67, retired assistant to the vice president of Pennzoil Co., died July 28 in a Franklin, Pa., hospital. Officer retired in 1956 after 25 years with the company.

James William Tucker, 47, chief engineer in Ringling, Okla., for Sinclair Pipe Line Co., died August 2 in Sapulpa, Okla., after a heart attack.

Clyde V. Berryman, 78, retired Texas operator, died recently at his home in Arvada, Colo.

Orlin D. Horne, 65, chemist with Continental Oil Co., died July 31 at his home in Ponca City, Okla.

This announcement is neither an offer to sell nor a solicitation of offers to buy any of these securities. The offering is made only by the applicable Prospectus.

NEW ISSUES

July 29, 1959

Transcontinental Gas Pipe Line Corporation

$20,000,000

First Mortgage Pipe Line Bonds, 5⅛% Series Due 1980

(Due February 1, 1980)

Price 99.69%

Plus accrued interest from August 1, 1959

150,000 Shares

Cumulative Preferred Stock, $5.60 Series

(Without Par Value—Stated Value $100 per Share)

Price $100 Per Share

Plus accrued dividends from August 11, 1959

Copies of the applicable Prospectus may be obtained in any state only from such of the several Underwriters, including the undersigned, as may lawfully offer the securities in such state

White, Weld & Co. — Stone & Webster Securities Corporation

Blyth & Co., Inc. — Eastman Dillon, Union Securities & Co. — The First Boston Corporation

Glore, Forgan & Co. — Goldman, Sachs & Co. — Harriman Ripley & Co. Incorporated — Kidder, Peabody & Co.

Lazard Frères & Co. — Lehman Brothers — Merrill Lynch, Pierce, Fenner & Smith Incorporated

Paine, Webber, Jackson & Curtis — Smith, Barney & Co. — Dean Witter & Co.

Lube sales gain less than energy use

BY JOHN C. CASPER

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,780,310	DOWN	49,095	UP	135,790
Crude stocks	264,732,000	DOWN	5,635,000	UP	15,948,000
Completions	1,022	DOWN	36	UP	92
Refinery runs	7,997,000	UP	45,000	UP	272,000
Gasoline stocks	186,496,000	DOWN	1,661,000	UP	7,781,000
Kerosine stocks	29,298,000	UP	334,000	UP	3,384,000
Distillate stocks	139,154,000	UP	4,691,000	UP	18,737,000
Residual stocks	55,668,000	UP	879,000	DOWN	11,219,000
Four-product stocks	410,616,000	UP	4,243,000	UP	18,683,000
Total imports	1,323,100	UP	98,400	DOWN	331,200

SALES of automotive lubricating oils amounted to almost 22,200,000 bbl. last year, according to data collected and compiled by the Census Bureau of the Department of Commerce. This was the fourth survey in a series initiated and financed by the API.

Sales of Oils and Greases

(Thousands of barrels)

	1958*	1956*	1951	1947	1958 % automotive
Alabama	587	588	463	464	62.59
Arizona	257	276	216	115	71.88
Arkansas	352	367	341	333	74.91
California	3,663	3,459	4,083	2,219	63.12
Colorado	403	422	360	252	69.19
Connecticut	474	499	467	471	51.70
Delaware	91	80	70	72	61.85
D. C.	96	108	141	107	83.40
Florida	837	821	855	584	66.28
Georgia	743	771	560	564	66.89
Idaho	162	149	145	117	77.90
Illinois	2,619	2,726	2,600	2,615	48.26
Indiana	1,175	1,262	1,144	1,073	52.78
Iowa	677	660	657	665	76.77
Kansas	809	774	707	640	70.53
Kentucky	615	600	545	525	59.20
Louisiana	1,002	966	732	775	57.39
Maine	183	167	162	184	74.68
Maryland	548	492	522	606	59.52
Massachusetts	795	799	927	896	51.83
Michigan	2,120	2,361	2,288	2,063	49.36
Minnesota	894	827	761	732	70.56
Mississippi	359	366	280	300	77.40
Missouri	1,089	1,081	1,022	917	62.49
Montana	203	199	170	147	83.82
Nebraska	369	380	427	313	82.51
Nevada	58	66	51	56	87.07
New Hampshire	85	88	73	98	78.40
New Jersey	1,744	1,945	1,928	1,857	34.51
New Mexico	221	208	153	130	74.93
New York	2,282	2,312	2,448	2,590	55.29
North Carolina	702	667	619	575	73.51
North Dakota	211	210	186	168	88.95
Ohio	2,596	2,940	2,516	2,391	46.87
Oklahoma	580	620	650	688	79.09
Oregon	467	456	439	280	64.96
Pennsylvania	2,688	3,876	3,831	3,448	45.35
Rhode Island	153	234	236	171	65.51
South Carolina	314	349	322	298	76.92
South Dakota	202	190	170	145	91.99
Tennessee	655	696	600	504	70.07
Texas	3,080	3,528	2,785	2,256	57.19
Utah	234	225	176	130	63.60
Vermont	64	58	61	85	73.58
Virginia	637	613	815	656	66.09
Washington	567	566	586	384	68.77
West Virginia	534	640	582	541	38.03
Wisconsin	829	887	875	864	62.09
Wyoming	124	103	101	90	64.63
Total U. S.	40,149	42,677	40,848	36,154	58.45

*Excludes sales to federal Government.

Total sales of all oils and greases, including sales to the federal Government, dropped to a total of 41,656,000 bbl. in 1958 from 44,283,000 bbl. in 1956. The survey of 1951 sales showed a total of 40,848,000 bbl. for a moderate increase over the 36,154,000 bbl. reported in 1947.

Gains by automotive oils accounted for most of the increase between 1947 and 1956. In this 9-year period, these oils gained 5,600,000 bbl. or 32.1%. Registration of nonmilitary vehicles increased 72.3% in the same period.

Since decline in the number of military vehicles could not account for the wide difference in these percentage increases, the figures are further proof of lower motor-oil consumption by the average automobile or truck.

This trend shows up even more in the comparisons of figures for 1956 and 1958. There was a decline in motor-oil consumption of 848,000 bbl. or 3.7% during the period while automobile registrations moved up 5.0%.

Each survey showed an increase in consumption of aviation oils. The total for 1947 was 258,000 bbl. By 1958, consumption was up to 1,100,000 bbl.

The survey also proves that industrial plants are using less oil to produce a given volume of goods than in the early postwar years.

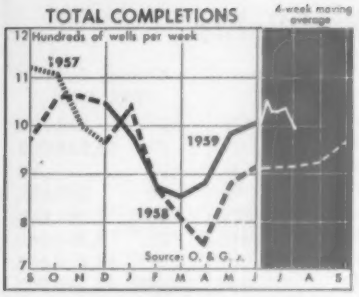
For the period 1947-51, the Federal Reserve Board's production index climbed 20%. Sales of industrial oils gained 6.4%. Again, the increase of 19.2% in the FRB index for the 1951-56 period produced a gain of only 1.1% in use of industrial oils.

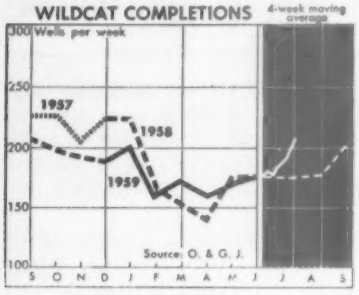
General refineries, those with lube capacity less than 8% of crude capacity, accounted for 77.44% of sales of automotive oils last year. Lubricating refiners sold 10.02% of the total. Compounders supplied 7.04%, and marketers accounted for 5.5%.

The table lists total sales of oils and greases by states. Note that several states used less oil in 1958 than in 1947.

The last column shows how much of each state's total 1958 sales was automotive oil and grease. States with low numbers are in the major industrial areas. High numbers indicate low consumption of industrial oils. Automotive oils and greases represented only 34.51% of total lube sales in New Jersey last year. South Dakota had the highest ratio of automotive oil sales to total, 91.99%.

DRILLING





Active Rotary Rigs

	8-3-59	7-27-59	8-4-58
Alabama	9	9	6
Arkansas	12	15	25
Arizona	1	1	0
California	90	88	77
Land	88	83	(*)
Offshore	2	5	(*)
Colorado	59	57	47
Florida	1	1	1
Land	0	0	1
Offshore	1	1	0
Illinois	44	38	44
Indiana	6	6	5
Iowa	2	2	3
Kansas	118	140	134
Kentucky	5	4	10
Louisiana	344	364	289
North	39	45	43
S. Inland waters	134	144	(*)
S. Land	115	120	205
Offshore	56	55	41
Maryland	0	0	0
Michigan	30	26	13
Mississippi	65	65	37
Missouri	0	1	1
Montana	30	27	19
Nebraska	26	27	27
Nevada	1	1	0
New Mexico	109	110	100
New York	1	1	2
North Dakota	28	31	34
Ohio	4	5	0
Oklahoma	223	236	216
Oregon	0	0	1
Pennsylvania	10	9	10
South Dakota	3	3	1
Texas	759	767	652
S. Inland waters	6	10	(†)
S. Land	184	198	146
Offshore	2	0	1
North-East	148	150	(*)
West Central	271	265	(*)
West	148	144	(*)
Utah	34	33	32
Washington	2	1	0
West Virginia	10	11	4
Wyoming	83	87	61
Total U. S.	**2,109**	2,166	1,851
Western Canada	150	145	139
Eastern Canada	0	0	2
Grand Total	2,259	2,311	1,992

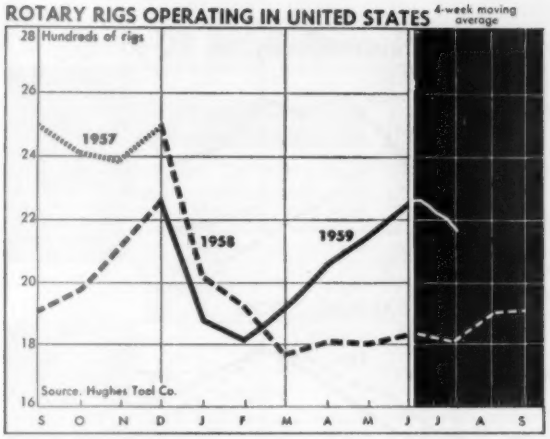
Hughes Tool Co. report. *Comparisons not available due to change in method of reporting. †Included in South-Land.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED AUGUST 1, 1959

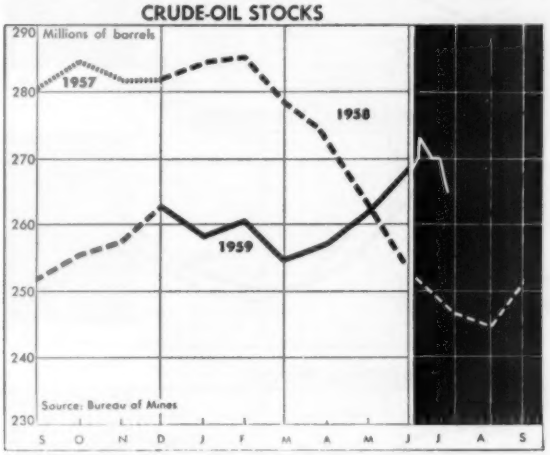
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	2	1	0	0	1	0	23,178	57	42	1	0	0	0	1	13	16
Arkansas	14	5	0	1	8	0	46,508	497	387	4	0	0	1	3	88	97
California	32	17	0	2	13	0	170,522	876	983	8	0	0	0	8	210	219
Colorado	14	2	0	0	11	1	60,164	435	451	10	2	0	0	8	259	253
Illinois	56	29	0	0	27	0	120,396	1,265	1,212	11	1	0	0	10	205	241
Indiana	16	6	0	0	10	0	27,667	467	431	5	1	0	0	4	156	160
Kansas	88	33	0	6	49	0	325,911	2,310	2,185	34	1	0	0	33	540	460
Kentucky	58	20	0	14	24	0	58,643	1,465	632	16	0	0	0	16	115	71
Louisiana	84	32	9	9	34	0	591,828	2,084	1,954	13	0	0	1	12	271	276
North	39	16	0	8	15	0	147,993	758	684	8	0	0	1	7	108	100
South	37	12	8	0	17	0	357,190	1,098	1,008	5	0	0	0	5	153	160
Offshore	8	4	1	1	2	0	86,645	228	262	0	0	0	0	0	10	16
Michigan	23	4	0	0	11	8	68,682	358	247	6	0	0	0	6	88	82
Mississippi	16	8	1	0	7	0	154,060	367	229	4	0	0	0	4	170	111
Montana	2	2	0	0	0	0	8,805	177	195	0	0	0	0	0	57	86
Nebraska	19	5	0	0	14	0	113,757	489	403	9	0	0	0	9	206	186
New Mexico	56	28	2	9	15	2	194,660	1,138	1,135	9	1	0	0	8	137	149
West	31	12	2	9	6	2	87,307	520	541	3	0	0	0	3	42	64
East	25	16	0	0	9	0	107,353	628	594	6	1	0	0	5	95	85
New York	20	12	0	1	0	7	26,945	169	335	0	0	0	0	0	13	32
North Dakota	8	4	0	0	4	0	81,697	302	263	2	0	0	0	2	60	89
Ohio	0	0	0	0	0	0	0	553	616	0	0	0	0	0	15	7
Oklahoma	92	53	3	5	28	3	365,367	3,390	3,762	15	2	0	1	12	493	530
Pennsylvania	12	0	0	7	5	0	73,653	323	310	4	0	0	0	4	9	9
Texas	348	174	8	20	134	12	1,543,308	11,162	10,535	68	3	1	1	63	2,084	2,156
Dist. 1	9	4	0	1	4	0	32,153	657	564	4	0	0	1	3	185	230
Dist. 2	21	4	3	3	11	0	132,825	477	447	5	0	0	0	5	138	119
Dist. 3	30	12	1	1	16	0	208,403	691	768	9	0	0	0	9	142	170
Dist. 4	26	8	1	4	13	0	128,668	770	712	5	0	1	0	4	188	208
East	27	21	1	0	5	0	89,437	692	718	5	0	0	0	5	137	205
Dist. 7-B	35	12	0	1	21	1	112,415	1,547	1,408	8	0	0	0	8	405	391
West	114	79	0	1	33	1	577,109	3,433	3,077	19	1	0	0	18	467	433
Dist. 9	64	27	0	1	26	10	175,282	2,108	2,105	11	2	0	0	9	357	339
Dist. 10	22	7	2	8	5	0	87,016	787	736	2	0	0	0	2	65	61
Utah	10	4	0	0	6	0	38,791	195	239	4	0	0	0	4	53	47
West Virginia	12	2	0	10	0	0	29,319	428	403	0	0	0	0	0	13	11
Wyoming	38	16	1	2	16	3	200,873	558	419	11	0	0	1	10	186	120
Misc. (Ariz., S. D.)	2	1	0	0	1	0	14,803	67	57	2	1	0	0	1	36	49
Total U. S.	**1,022**	458	24	86	418	36	4,339,537	29,132	27,425	**236**	12	1	5	218	5,477	5,457
Previous week	1,058	524	27	62	408	37	4,470,711	.....	.....	228	18	4	10	196	.....	.....
Cum. 1959	29,132	14,776	716	2,102	10,747	791	120,364,707	.....	.....	5,477	528	77	163	4,709	.....	.....
Cum. 1958	27,425	13,527	669	2,064	10,474	691	114,718,604	.....	.....	5,457	545	90	163	4,659	.....	.....
Western Canada	65	36	0	5	24	0	306,350	1,421	1,425	23	2	0	2	19	429	414
Ontario	0	0	0	0	0	0	0	123	.....	0	0	0	0	0	.....	.....

ROTARY RIGS OPERATING IN UNITED STATES

4-week moving average



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	7-25-59	7-18-59	7-26-58
Pennsylvania	2,528	2,506	2,816
Other Appalachian	1,993	1,936	1,409
Illinois, Indiana, Michigan	9,508	10,197	11,004
Nebraska and North Dakota	2,916	2,789	1,877
Kansas	9,851	10,381	9,856
Oklahoma	17,053	17,026	15,145
Arkansas	2,060	2,011	2,061
Louisiana	19,443	19,692	15,859
North	3,152	3,174	2,898
South	16,291	16,518	12,961
Mississippi, Alabama, Florida	2,549	2,609	2,256
New Mexico	7,708	8,054	6,061
Texas	115,899	117,532	102,735
East Texas	9,204	8,991	6,962
West Texas	55,477	57,157	50,590
Texas Gulf	19,965	19,722	19,624
Other Texas	31,253	31,662	25,559
Wyoming	15,052	15,946	14,290
Other Rocky Mountain	9,714	9,260	9,761
California	31,889	32,128	37,542
Foreign	†16,569	18,300	16,112
Total	**264,732**	270,367	248,784

*Bureau of Mines. †Includes 4,228,000 bbl. in California.

DAILY AVERAGE PRODUCTION FOR WEEK

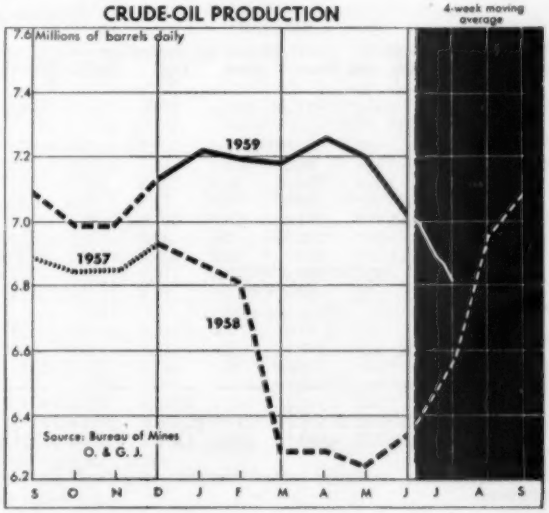
	August 1, 1959			July 25
	Crude oil	Lease condensate	Total	total
Alabama	16,300	.....	16,300	16,250
Arkansas	§48,835	315	§49,150	§51,275
California	851,400	.....	851,400	852,200
Colorado	123,500	.....	123,500	124,000
Eastern	40,900	.....	40,900	42,600
Florida	1,200	.....	1,200	1,200
Illinois	217,900	.....	217,900	219,200
Indiana	31,300	.....	31,300	32,000
Kansas	†301,600	.....	†301,600	†320,145
Kentucky	91,500	.....	91,500	91,500
Louisiana	882,775	98,500	981,275	981,200
North	110,275	5,000	115,275	115,200
South	772,500	93,500	866,000	866,000
Michigan	27,300	.....	27,300	27,200
Mississippi	127,500	4,275	131,775	131,775
Montana	80,000	.....	80,000	81,700
Nebraska	62,500	.....	62,500	63,400
Nevada	100	.....	100	100
New Mexico	288,000	3,800	291,800	291,800
North Dakota	38,000	.....	38,000	35,200
Oklahoma	†500,150	.....	†500,150	†524,000
Texas	2,407,000	71,675	2,478,675	2,478,675
Dist. 1	43,000	2,500	45,500	45,500
Dist. 2	98,000	7,900	105,900	105,900
Dist. 3	320,000	36,000	356,000	356,000
Dist. 4	167,000	8,500	175,500	175,500
Dist. 5	28,000	350	28,350	28,350
Dist. 6	101,000	6,500	107,500	107,500
East Texas field	128,000	.....	128,000	128,000
Dist. 7-B	128,000	100	128,000	128,000
Dist. 7-C	113,000	3,225	116,225	116,225
Dist. 8	970,000	3,800	973,800	973,800
Dist. 9	205,000	1,800	206,800	206,800
Dist. 10	106,000	1,000	107,000	107,000
Utah	115,800	.....	115,800	116,300
Wyoming	348,000	.....	348,000	347,500
Others	‡185	.....	‡185	‡185
Total U. S.	§6,601,745	178,565	**§6,780,310**	§6,829,405
Change from prev. week down			**§49,095**	.....
Canada	†491,000	.....	†491,000	†511,600

Total U. S. prod., January 1-August 1 ..... §1,517,381,200 bbl.
Same period last year (crude plus cond.) ..... *1,380,363,520 bbl.

*Includes 34,539,020 bbl. condensate. †Week ended previous Monday. ‡Arizona, South Dakota, and Washington. §Revised.

CRUDE-OIL PRODUCTION

4-week moving average



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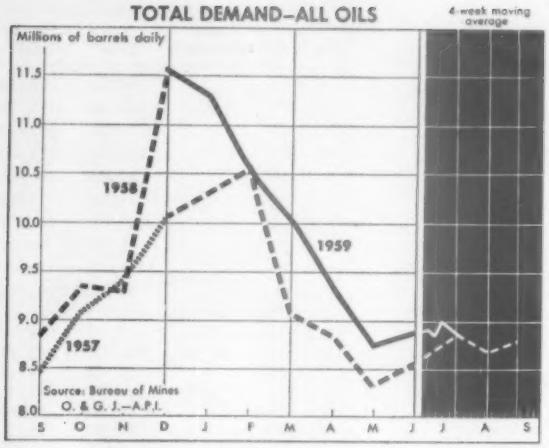
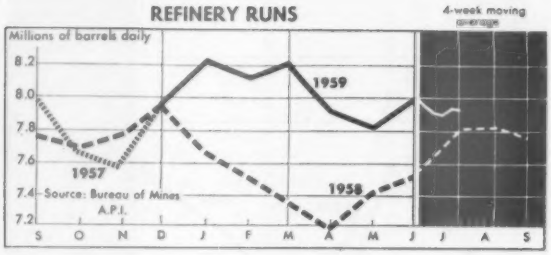
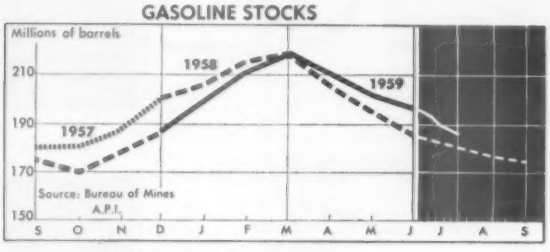
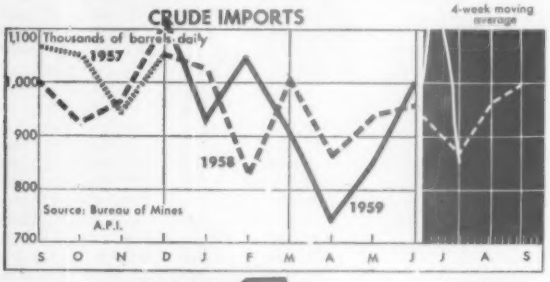
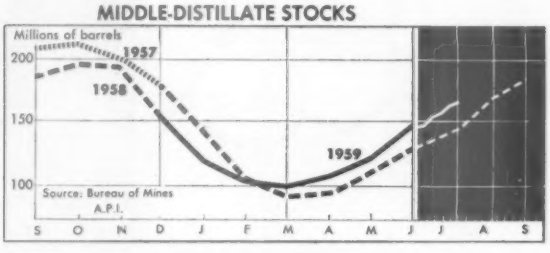
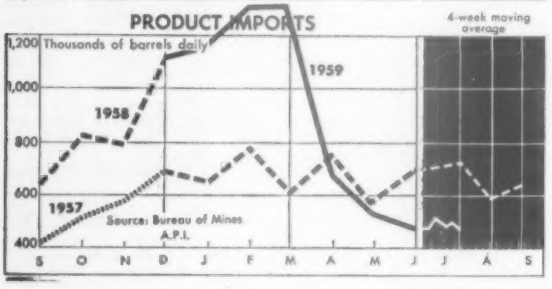


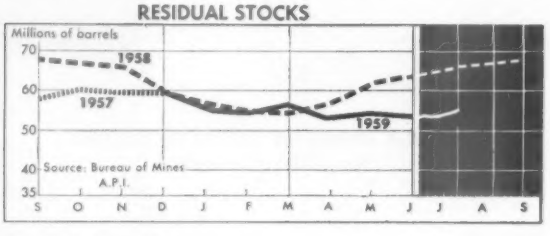












API REFINERY REPORT—JULY 31, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, July, 1958 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,141	551.4	17.4	370.0	190.0	45,040	10,864	50,791	12,338	1,093	497.9	20.1	285.4	171.9
Appalachian:														
Dist. 1	96	44.0	2.6	23.7	5.1	5,799	590	3,313	332	94	42.2	2.5	21.6	5.8
Dist. 2	100	56.2	1.4	16.3	10.9	2,799	528	1,244	211	108	55.4	5.7	17.3	7.3
Ind., Ill., Ky.	1,399	730.0	66.3	288.4	140.3	32,215	6,778	22,997	4,465	1,373	718.9	60.3	265.0	124.5
Minn., Wis., Dak.	113	58.7	4.4	25.7	13.6	6,276	1,203	6,291	441	109	53.0	5.7	28.4	10.0
Okla., Kans., Mo.	713	392.4	14.9	167.9	13.1	17,261	1,537	9,621	790	742	416.4	12.5	174.9	25.5
Inland Texas	292	244.7	7.6	48.0	24.2	7,259	383	1,932	2,102	272	192.9	5.3	45.3	18.2
Texas Gulf Coast	1,789	915.7	44.0	426.6	157.2	22,208	3,490	16,625	5,504	1,633	839.3	68.4	382.6	178.6
La. Gulf Coast	723	371.4	70.4	114.9	39.4	10,114	2,365	7,284	1,449	613	362.0	38.2	149.2	45.0
N. La. and Ark.	71	31.4	1.7	16.4	4.4	4,543	722	2,299	146	100	41.7	4.3	25.5	6.6
Rocky Mountain:														
New Mexico	27	12.0	1.0	4.6	3.1	783	35	185	108	27	13.5	0.5	5.1	2.5
Other Rocky Mt.	327	153.9	2.9	71.1	40.0	5,022	376	2,851	1,107	294	134.6	3.5	61.1	30.7
West Coast	1,206	573.6	8.1	147.3	297.7	27,177	377	13,721	26,675	1,069	485.6	5.6	150.0	284.8
July 31, 1959	7,997	4,135.4	242.7	1,720.9	939.0	186,496	29,298	139,154	55,668	7,527	3,853.4	232.6	1,611.4	911.4
July 24, 1959	§7,952	§4,107.1	§293.7	§1,680.0	§901.9	188,157	28,964	134,463	54,789	.....	.....	.....	.....	.....
Aug. 1, 1958	7,727	4,099.0	244.0	1,679.1	1,014.4	178,715	25,914	120,417	66,887	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Revised.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
★ Regular (91 octane)	11.50-12.00
★ Premium (99 octane)	14.25-14.75
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.75
Regular (92 octane)	11.00
Premium (98 octane)	12.125
California (rack) (Los Angeles):	
Regular (88 octane)	12.00-12.50
Premium (94 octane)	13.00-13.50
Premium (100 octane)	14.50-15.00
Caribbean area (cargoes):	
Regular (87 octane)	10.375
Premium (97 octane)	12.00

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.25-9.75
Diesel oil (58 d.i. and above)	9.00-9.50
Distillate No. 1	9.00-9.50
Distillate No. 2	8.25-8.75
Gulf Coast (cargoes):	
Kerosine 41-43	8.50-8.625
Distillate No. 2	8.125-8.25
New York Harbor (barges):	
Kerosine 41-43	9.65-9.90
Distillate No. 2	9.15-9.40
Diesel fuel, 48-52 d.i.	9.30-9.55
Caribbean area (cargoes):	
★ Distillate No. 2	8.125

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank car	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

NOTICE

STARTING with the first issue in September, The Oil and Gas Journal will discontinue price reporting for natural gasoline, wax, and lubricating oils.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3): Residual fuel (max. 1% S)	$1.85-2.00
Gulf Coast (cargoes): Bunker C fuel	$2.00
New York Harbor (barges): Bunker C fuel	$2.27
Caribbean (cargoes): Bunker C	$2.00
California (rack): Bunker C fuel, Los Angeles	$2.15

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 pp., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i.	20.5
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	23

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Okla-homa	Gulf Coast Tex.*	West Tex.† N.M.	Wyo. (sour)
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17.17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.49	....	$2.35	2.06
21-21.9	2.50	2.52	....	2.38	2.11
22-22.9	2.60	2.55	....	2.41	2.16
23-23.9	2.69	2.58	$3.44	2.44	2.21
24-24.9	2.78	2.61	3.46	2.47	2.26
25-25.9	2.84	2.64	3.48	2.50	2.31
26-26.9	2.90	2.67	3.50	2.53	2.36
27-27.9	2.95	2.70	3.52	2.56	2.49
28-28.9	3.01	2.73	3.54	2.59	2.54
29-29.9	3.07	2.76	3.56	2.62	2.59
30-30.9	3.12	2.79	....	2.65	2.63
31-31.9	3.20	2.82	....	2.68	2.67
32-32.9	3.27	2.85	....	2.71	2.71
33-33.9	3.34	2.88	....	2.74	2.75
34-34.9	3.41	2.91	....	2.77	2.79
35-35.9	3.47	2.94	....	2.80	2.83
36-36.9	3.52	2.97	....	2.83	2.87
37-37.9	3.56	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 1-26-59; East of California, January 3-10, 1957; Pennsylvania Grade 4-1-59.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.25
Middle District	4.07
Southwest Pennsylvania	3.80
West Virginia	3.62
Buckeye Grade	3.47
Illinois Basin	3.00

FOREIGN

Canada:	
Leduc-Woodbend	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.34
San Joaquin, 41°-41.9°, Puerto La Cruz	3.08-3.10
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-USNH, clean (ATRS—30%)	$2.00
★ Carib.-USNH, dirty (ATRS—65%)	0.96
★ Carib.-UK, clean (Scale—42.5%) (18s. 7d.)	2.62

SELECTED MONTHLY DATA

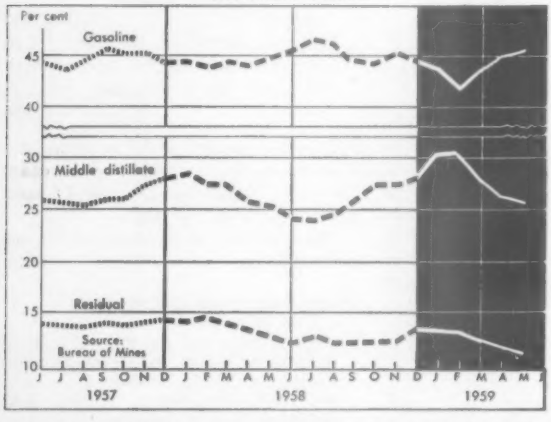
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

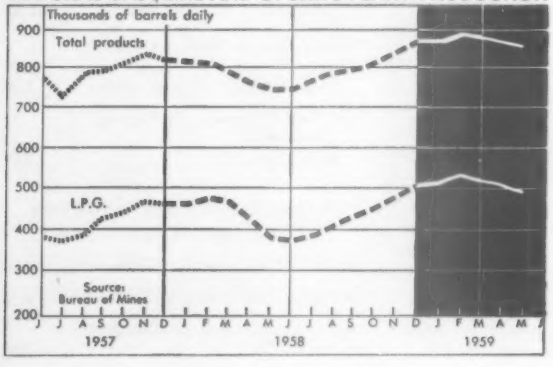
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
July 1959*	4,460	4,080	186,000
June 1959*	4,340	4,075	197,000
May 1959	4,193	3,961	204,710
August 1958	4,273	4,082	177,351
July 1958	4,303	4,017	188,705
KEROSINE			
July 1959*	190	250	29,400
June 1959*	155	265	27,500
May 1959	132	244	24,535
August 1958	172	265	28,662
July 1958	180	225	25,655
DISTILLATE			
July 1959*	1,100	1,720	139,800
June 1959*	1,140	1,800	119,700
May 1959	1,279	1,751	101,816
August 1958	1,091	1,706	139,862
July 1958	1,256	1,650	119,437
RESIDUAL			
July 1959*	1,250	930	55,800
June 1959*	1,400	950	53,600
May 1959	1,341	899	53,961
August 1958	1,332	961	67,230
July 1958	1,315	981	66,457

*Preliminary. †Thousands of barrels.

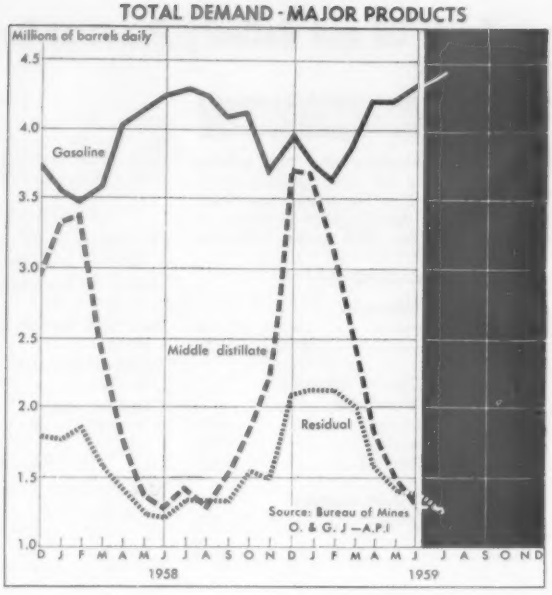
REFINERY YIELDS



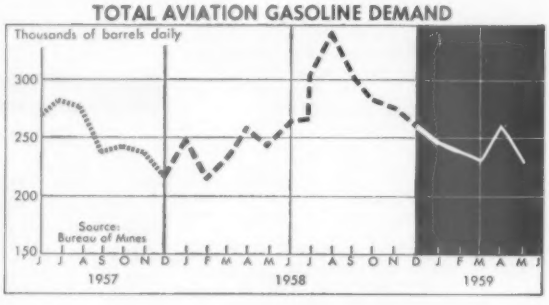
NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



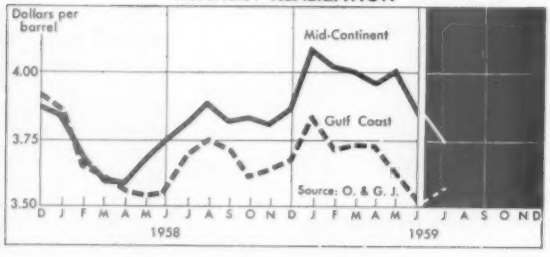
TOTAL DEMAND - MAJOR PRODUCTS



TOTAL AVIATION GASOLINE DEMAND



REFINERY REALIZATION



REFINERY REALIZATION

	July* 1959	June* 1959	May 1959	July 1958
Mid-Continent	$3.75	$3.85	$3.93	$3.81
Gulf Coast	3.58	3.53	3.66	3.68

*Preliminary

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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Telephone: AM 3-2611

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6,500' 2⅞" OD HYDRILL DRILL PIPE. HAVE TUBOSCOPED RECORD
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1—IDECO 5 SHEAVE CROWN BLOCK GROOVED FOR 1¼" LINE
1—B.S. & B. 1,500# TEST 2 STAGE HORIZONTAL SEPARATOR. JUST LIKE NEW
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90,000 ft.—12¾" OD x .375 Wall, 49.56# Lapweld Used Line Pipe. Single and Double Random Lengths, cleaned, straight and beveled for welding. Suitable for lines or piling. Located: Manhattan, Ill.

56,000 ft.—30" OD x .375 Wall, 118.65#, E.W., Prime Grade 5L-X52, 52,000# min. yield, Used Line Pipe, Range 3, cleaned, P.E., beveled for welding. Just like new. Located: near Jonesboro, La.

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IN STOCK NOW!

14,000'—	7⅝" OD x 29.70#	R-3	T&C	N-80
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3,000'—	13⅜" OD x 48.00#	R-2-3	T&C	H-40
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New Domestic Sub-standard Casing, with new API tested threads, couplings and thread protectors, this Pipe will serve the same as prime for all practical purposes.

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- 5—FURNACES 1,300 to 2,200 sq. ft. Heating Surface
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Ideco H-35 HYDRAIR Used Single Drum Draw Works, Serial No. 130, with Twin Disc Torque Converter, Kelco Manually Operated Make-up Cathead, Kelco Air Operated Breakout Cathead, Parkersburg 15" Double Hydromatic Brake, Lebus Drum Grooving and Two-Engine, Oil Bath Chain Compound with 2" Washdown Pump and Air Compressor, powered by 2—Waukesha 6WAKU Engines, Serial Nos. 729297 and 730001. (This is a fine, modern hoisting unit powered for "stretching" capacity—located at Oklahoma City).

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The following gas compressors and cylinders are for sale at reduced prices:

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Other high pressure cylinders for 9-11-13" horizontal compressors. (Le Roi).

Contact us and give us your requirements and we will quote you lowest price.

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Box L-448

The Oil and Gas Journal

Tulsa, Oklahoma

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CONTINENTAL OIL COMPANY

We have openings in district offices of our domestic producing operations. Minimum of three years production experience plus BS degree required. Experience in reservoir engineering, waterflooding, down-hole corrosion, gas operations, or general field operations is acceptable. Response should include salary expected and complete resume of education and experience. Reply to Chief Engineer, Production Department.

Continental Oil Company,
P. O. Box 2197, Houston, Texas.

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Desire Mechanical or Petroleum Engineers with oil field background, preferably with design experience.

Engineers presently employed by Oil Companies will be considered and employed only with the understanding and approval of their company.

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HELP WANTED

WANTED: Refinery Engineer, under 42, with five to ten years experience in maintenance and construction in refinery having catalytic cracking, alkylation, catalytic reforming and asphalt facilities, to be maintenance engineer in 20,000 barrel refinery located in southwest. Send detailed resumé of experience with salary requirements to Box L-451, The Oil and Gas Journal, Tulsa, Oklahoma.

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...with strong background or recent practical experience in statistical analysis and design of experiments for staff position in development division of a growing organization. Age 25 to 40. Excellent opportunity for an energetic and creative engineer. Reply D. C. Williams, Manager-Development Division, United Carbon Company, Aransas Pass, Texas.

RESERVOIR ENGINEER

We have an opportunity for a young (to 35) engineer with 2 to 3 years reservoir experience plus sound field background. Send a complete resume to Industrial Relations Department, Anderson-Prichard Oil Corporation, Liberty Bank Building Oklahoma City.

MUD ENGINEERS FOR LIBYA

Opportunities in Libya for single status mud engineers with at least two years experience plus knowledge of mud logging. Require geology or engineering degree. Salary $10,000 per year. Meals and lodging furnished on camp jobs. Give full resume of background in first letter. Box L-443, The Oil and Gas Journal, Tulsa, Oklahoma.

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Physicist (Geophysicist) to develop devices for measurement of natural and induced emanations and effects from a submarine arising from mechanical, electromagnetic, electrochemical, nuclear biological and gravitational interactions.

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PETROLEUM Engineer—Established consulting firm specializing in evaluation, reserves, reservoir engineering and secondary recovery. Mid-Continent Area. Furnish references, complete details of education and experience. Also past employment record and salary received. All replies considered confidential. Reply to: Box L-450, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION: Permanent location with small independent involving very little travel. Geological subsurface exploration training and experience necessary. Knowledge of geophysics (particularly seismic) would be helpful. Applicants should have personality and ability necessary for eventual executive position. All replies confidential. Sand complete educational and experience background. Box L-444, The Oil & and Gas Journal, Tulsa, Oklahoma.

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1600 West Eight Mile Road
Ferndale 20, Michigan

SITUATION WANTED

ACCOUNTANT—Presently Controller for large Texas steel fabrication plant. Position eliminated by parent corporation merger. Heavy industrial experience. Two years oil production. Standard cost and systems installation. Box L-433, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER (Reg.) 31, 6 yrs. Diversified experience in drilling, workovers, completions, production, and reservoir, P. O. Box 8506, Houston, Texas.

DRILLING AND PRODUCTION supervisor or engineer. Ten years experience Offshore, South Louisiana, Canada, Rocky Mountain, Mid-Continent & Illinois Basin. Major Oil Company, Independent and Drilling Contractor. M. E. Degree. Prefer Gulf Coast and Offshore Operations. Would relocate. Resume on request. Box L-436, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, 32 degree, 5 years experience Texas, Louisiana, Arkansas, Alabama, Oklahoma, Ohio, Kentucky desires position with company or partnership with individual. Box L-449, The Oil & Gas Journal, Tulsa, Okla.

GEOLOGIST—age 35. Eight years experience all phases petroleum exploration in the Rocky Mountains. Best references. Desire connection with company in Rocky Mountain area. Box L-445, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—age 30, family, 5½ years company and consulting experience over all Oklahoma. Desires relocation with small company or drilling concern. Consider foreign. Box L-446, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM AND MECHANICAL ENGINEER desires production foreman or production engineering position with aggressive independent. 9 years supervisory field experience with major in drilling, production, water flooding. Will relocate, age 34, family, registered, employed. Box L-434, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER—B.S. Petroleum Engineering (Geology Option), 10 years experience including drilling, completions, waterflood, evaluations, and supervision. Capable of assembling prospects as well as doing Geological work. Desire position with aggressive independent on salary basis or retainer and interest basis. Box L-428, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATION WANTED

PRODUCTION Supervisor 34, 14 years diversified experience, 11 years with major dynamic worker, will relocate, excellent references, married, presently employed. Box L-452, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST: 12 years interpretive, supervisory experience through out Mid-Continent; desires position in land or geophysics. Box L-423, The Oil and Gas Journal, Tulsa, Okla.

BUSINESS SERVICE

Delaware Corporations formed and serviced American Guaranty & Trust Company. P O. Box 487, Wilmington, Delaware

ROYALTIES

ROYALTIES PRODUCING and non-producing oil leases in active territory. H. E. Clement, Box 65, Norman, Oklahoma.

OFFERING OIL AND GAS Income Royalties and those ahead of drilling. A. S. Berry 109 Midco Bldg., Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

SOUTH CENTRAL KENTUCKY SHALLOW DRILLING DEAL—1,200 acres RUSSELL COUNTY. Cash required $1,800.00 Plus $5,000.00 oil payment and 1/32 override. Inspection invited. Come or wire Wilbur V. Cravens, Russell Springs, Kentucky.

I WILL BUY your producing interest or drill your shallow prospect. U. S. Andersen, 8350 Santa Monica Blvd., Los Angeles 46, Calif.

CUMBERLAND COUNTY Kentucky—200 acres near New Calloway Creek, Knox Well and other old and new production. Commercial lease, five year term. $1.00 rental, $20.00 per acre, 1/8 override. Wire, phone: Luther L. Shepherd, Burkesville, Kentucky.

OIL LEASES in Kentucky—5,000 acres in Grayson County with good geology, rental due September 1, Act now. Also blocks in Breckinridge and Monroe Counties. Frank H. Patterson, Box 91, Owensboro, Ky.

KENTUCKY—40,000 acres in Clinton, Wayne, Pulaski, Russell and McCreary Counties in blocks of 80 to 6,000 acres. Acreage adjoining, and near production. For information write P. O. Box 478, Burnside, Kentucky.

SACRIFICE OF perpetual mineral and royalty interests located several states. P. O. Box 6287, Dallas 19, Texas.

IOWA—Leased 8,000 acres on anti-clime. Will consider sale also authentic deals. P.O. Box 122, Siloam Springs, Arkansas.

FOR QUICK SALE

16,500 acres in one tract located in the Hot Lucera Basin (O&GJ 11/10/58, page 207), Catron County, N.M. Due to interests in foreign country, we will sacrifice this acreage for $1 per acre plus 1/64 override. Box L-447, The Oil and Gas Journal, Tulsa, Oklahoma.

ALLEN COUNTY, Kentucky—Six leases totaling 607 acres, 1/8 to 1/5 overrides. Shallow drilling. $6,000. Douglas, Box 3242, Nashville, Tenn.

WRITE FOR Free Map. Apache County, Arizona, leases available. Box 31 R 226, The Oil & Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif.

KENTUCKY OIL LEASES—Grayson Hardin or Ohio Counties. Will sell one farm or 6,000 acres—Blocks for drilling contracts, Great possibilities if you get in now. Phone now. Frank H. Patterson, Mu 4-1738, (home) Owensboro, Ky. or Upton, Ky.

KENTUCKY OIL LEASES

In Lincoln County. Well reported 127 ft. 20 bbls. day in July. Now reported to 100 daily. Such wells drilled in one week. Oil sells $2.60 bbl. net. Low cost leases now, but fast increase. Free maps and information. John L. Donahue, 430 16th Street, Denver 2, Colorado.

WATER FLOOD PROPERTY

276 acre lease fronting Caney River near Bartlesville, on structure and producing for over 30 years, ready for flooding. A good deal for qualified party. See:

H. W. DIXON, Hotel Burlingame, Bartlesville, Aug 16-28; Thereafter, P. O. BOX 991, Scottsdale, Arizona.

PRODUCTION FOR SALE

FOR SALE: Because of pressure of other business interests, owners are offering three producing oil wells and leases in Hope Twp. Barry County Michigan together with leases in adjoining Calhoun County. Great Lakes Oil Co. 4755 N. Rockwell St. Chicago 25, Ill.

PRODUCTION WANTED

WANTED: 250,000 barrels and up, or equivalent gas, fair price, cash, with or without development drilling and /or drilling deals. Box L-441, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Oil properties. 100 to 5,000 barrels daily in Oklahoma and Kansas. Morris Sitrin, P. O. Box 1160, Tulsa, Okla.

SHALLOW DRILLING PROSPECTS WANTED

Interested in drilling or participating in shallow (3000' or less) drilling prospects, water floods included. Please include sufficient data to allow preliminary evaluation.

Syndicate Oil Corporation
409 Beacon Building
Tulsa, Oklahoma

REAL ESTATE

WILL BUILD TO SUIT
BUSINESS TENANT
Property half block from New Skelly Building now available for business construction. Either 100 or 162 ft. frontage by 130 ft. deep. Located at 1515 So. Boulder, Tulsa, Okla.
Write: H. H. Wright
3708 So. Yale or Call: RI 2-4034
Tulsa, Oklahoma

AIRCRAFT

EXEC.
TWIN BEECH 18

Lease or purchase, 7 pegr. Deluxe interior, card tables, power step, lavatory, dual omni radio. Low eng. time. New lic.

AIRLINE PRODUCTS INC.
5536 Satsuma Avenue
No. Hollywood, Calif.
TRiangle 7-4742

FOR RENT

DRILLING TOOLS FOR RENT:

Drawworks, rotary tables, traveling blocks, swivel and hooks, kelly, mud pits, mud pumps, blowout preventor, mud mixing pumps, Drill Pipe and Drill Collars and other drilling equipment.

Drilling Equipment for Sale

Call: **CENTRAL TOOL & SUPPLY COMPANY**

MAin 4-6651, Liberal, Kansas
CEntral 2-6318, Oklahoma City

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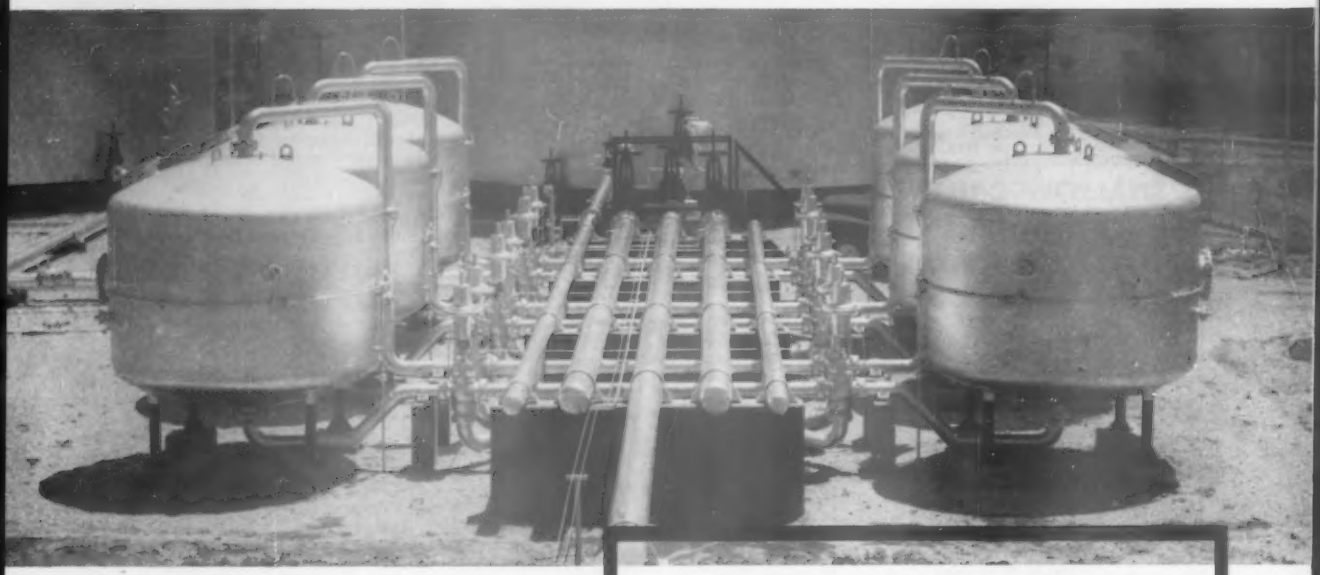
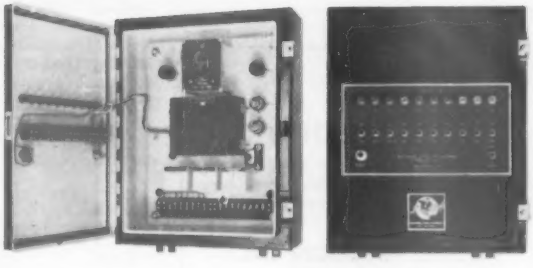
NATIONAL® AUTOMATIC PROGRAMMER
for backwashing from 1 to 10 filters in sequence

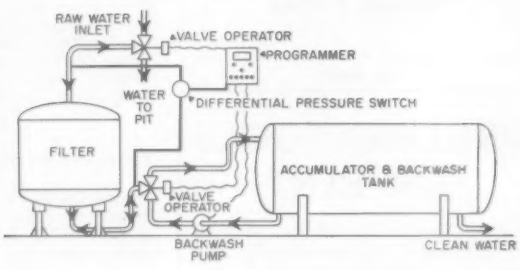


Stop wasting power and water by backwashing filters haphazardly. National's Model BFP-100 Automatic Backwash Programmer removes the human error from backwashing and at the same time provides considerable savings in labor, water and power.

The Programmer is actuated by a differential pressure switch which senses the difference in pressure across the filter bed. The length of backwash can be readily changed by changing the setting of the Programmer Timer. The Programmer can be operated automatically or manually, and individual filters can be by-passed.

The Backwash Filter Programmer is a rugged industrial-type electrical control system designed for long life and trouble-free operation. The housing is weather-proof, dust-tight (NEMA Type 12) for wall mounting. All terminals, sockets and other electrical components are clearly marked to assist in installation and service of the system. The panel requires only 110 VAC, 60 cycle for operation.





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It's a National®

NATIONAL TANK COMPANY

DRAWER 1710

TULSA, OKLAHOMA

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Each Mission Mud Pump Valve is best for its service; one is best for your service. And more than that, each has been tested under conditions worse than anything met in the field. These valves have stamina designed in, built in, and ***kept in*** with special long-life rubber compounds, advanced metallurgy. Because they're better, they'll cut replacement cost, increase efficiency of pump operation.

Mission MUD MONARCH® Mud Pump Valves *for extremely high and medium pump pressures.* Unique design with exclusive seal ring results in exceptional performance as this ring seals effectively even when body and seats are severely worn.

Mission SUPER-SERVICE® Mud Pump Valves *for medium pump pressures.* Four crossarms provide extra strength and large striking surface, assuring long valve seat life without restricting flow area.

Mission SILVER TOP® Mud Pump Valves *for low and medium pump pressures.* Replaceable, wear-taking bushing greatly reduces valve seat replacement costs. The famous Compound 308® inserts are interchangeable with Mission Super-Service Valves.

Mission Mud Pump Valves are available for all popular makes of mud pumps. Buy them anywhere through your supply store.

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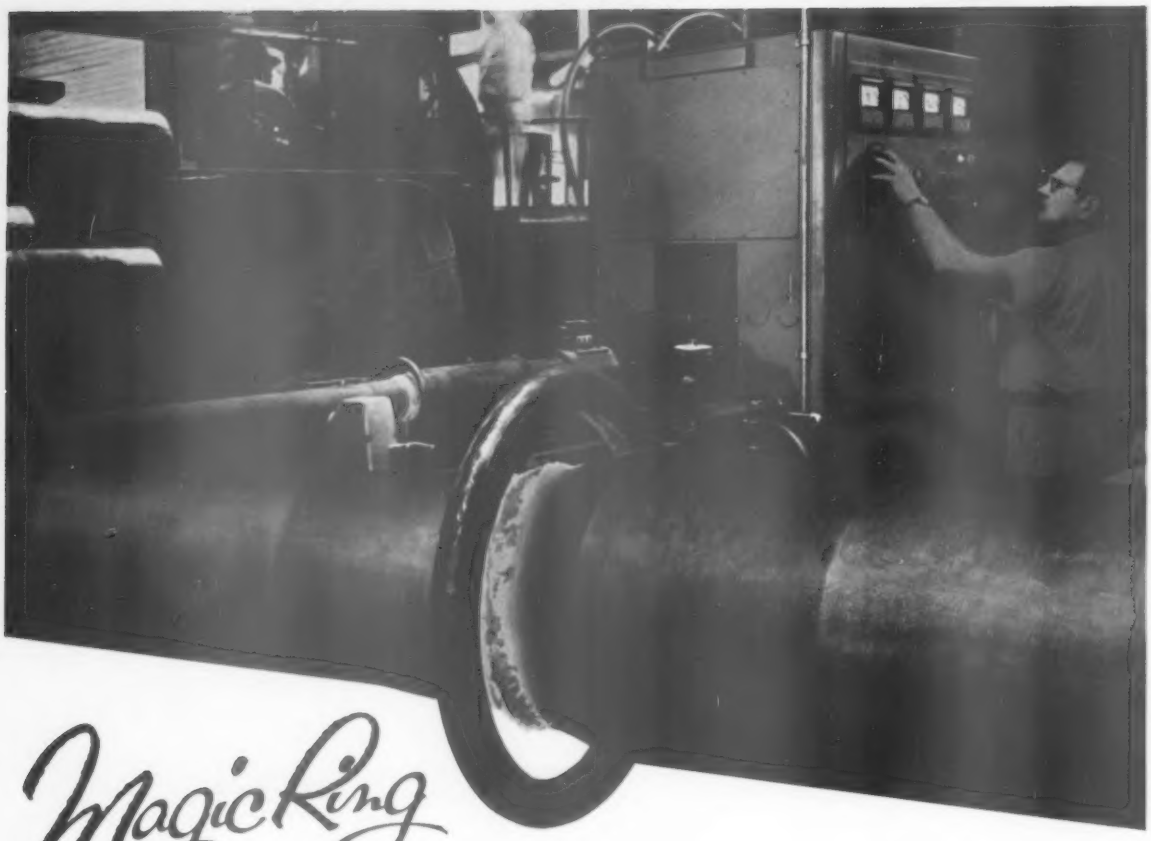


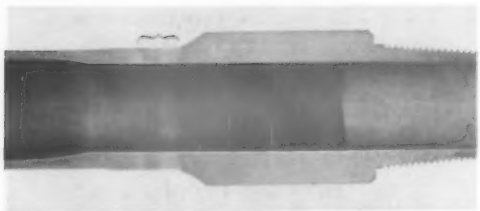
Magic Ring

makes Hughes Flash-Weld twice as strong!

A new process, developed by Hughes for heat treating "Flash-Weld" tool joint-to-pipe connections, has resulted in a major advance in drillstem construction. In this process an induction coil is used to normalize and stress-relieve the weld area—more than doubling the tension-impact strength of the connection.

Special electrical equipment, built to Hughes' own exacting specifications, performs this operation. After each joint is flash-welded to the pipe, the weld is automatically positioned inside the "magic ring." Induction heating to closely controlled temperature converts the metallographic structure within the weld affected area — ⅜" to ¾" on each side of weld—to a fine-grained, ductile, strong condition. After cooling, the weld is positioned in a second coil and heated to correct temperature for stress-relieving.

The result — proved in over 200 full scale tension impact tests — is a tool joint-to-pipe connection with metallographic uniformity across the weld that had not heretofore been available to the industry.



This cross-section of a finished "Flash-Weld" tool joint shows the very small area—only about ¾" on either side of the weld — that is affected by the new Hughes induction heat treating process. No other part of the pipe or joint reaches a temperature high enough to alter its metallurgical properties.

50TH ANNIVERSARY YEAR
1909 – 1959

FLASH-WELD
A DEVELOPMENT
OF
HUGHES
TOOL COMPANY
HOUSTON, TEXAS